

FACTORY

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ROBERT B. ROOSEVELT

President American Fisheries Society 1873-1882.
Born 1829. Died 1906.

By courtesy of Dr. Hugh M. Smith, Washington, D. C.

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TRANSACTIONS
OF THE
AMERICAN
FISHERIES SOCIETY

AT ITS
Thirty-seventh Annual Meeting

SEPTEMBER 21-24, 1908,

At Washington, D. C.

APPLETON, WIS.
THE POST PUBLISHING COMPANY, PRINTERS AND BINDERS
1908

Officers for 1908-1909

President..... TARLETON H. BEAN, Albany, N. Y.
Vice-President..... SEYMOUR BOWER, Detroit, Mich.
Recording Secretary..... GEORGE F. PEABODY, Appleton, Wis.
Corresponding Secretary, CHARLES G. ATKINS, East Orland, Me.
Treasurer..... C. W. WILLARD, Westerly, R. I.

30 30 30

EXECUTIVE COMMITTEE.

W. E. MEEHAN, *Chairman*, Albany, N. Y.
S. F. FULLERTON, St. Paul, Minn.
FRANK MILLER, Put-in-Bay, Ohio.
G. W. FIELD, Boston, Mass.
W. P. MORTON, Providence, R. I.
GEO. T. MATHEWSON, Enfield, Conn.
JABE ALFORD, Madison, Wis.

AMERICAN FISHERIES SOCIETY

Organized December, 1870.

PRESIDENTS.

1. William Clift.....	1870-1871
2. William Clift.....	1871-1872
3. William Clift.....	1872-1873
4. Robert B. Roosevelt.....	1873-1874
5. Robert B. Roosevelt.....	1874-1875
6. Robert B. Roosevelt.....	1875-1876
7. Robert B. Roosevelt.....	1876-1877
8. Robert B. Roosevelt.....	1877-1878
9. Robert B. Roosevelt.....	1878-1879
10. Robert B. Roosevelt.....	1879-1880
11. Robert B. Roosevelt.....	1880-1881
12. Robert B. Roosevelt.....	1881-1882
13. George Shepard Page.....	1882-1883
14. James Benkard.....	1883-1884
15. Theodore Lyman.....	1884-1885
16. Marshall McDonald.....	1885-1886
17. W. M. Hudson.....	1886-1887
18. William L. May.....	1887-1888
19. John H. Bissell.....	1888-1889
20. Eugene G. Blackford.....	1889-1890
21. Eugene G. Blackford.....	1890-1891
22. James A. Henshall.....	1891-1892
23. Herschel Whitaker.....	1892-1893
24. Henry C. Ford.....	1893-1894
25. William L. May.....	1894-1895
26. L. D. Huntington.....	1895-1896
27. Herschel Whitaker.....	1896-1897
28. William L. May.....	1897-1898
29. George F. Peabody.....	1898-1899
30. John W. Titcomb.....	1899-1900
31. F. B. Dickerson.....	1900-1901
32. E. E. Bryant.....	1901-1902
33. George M. Bowers.....	1902-1903
34. Frank N. Clark.....	1903-1904
35. Henry T. Root.....	1904-1905
36. C. D. Joslyn.....	1905-1906
37. E. A. Birge.....	1906-1907
38. Hugh M. Smith.....	1907-1908
39. Tarleton H. Bean.....	1908-1909

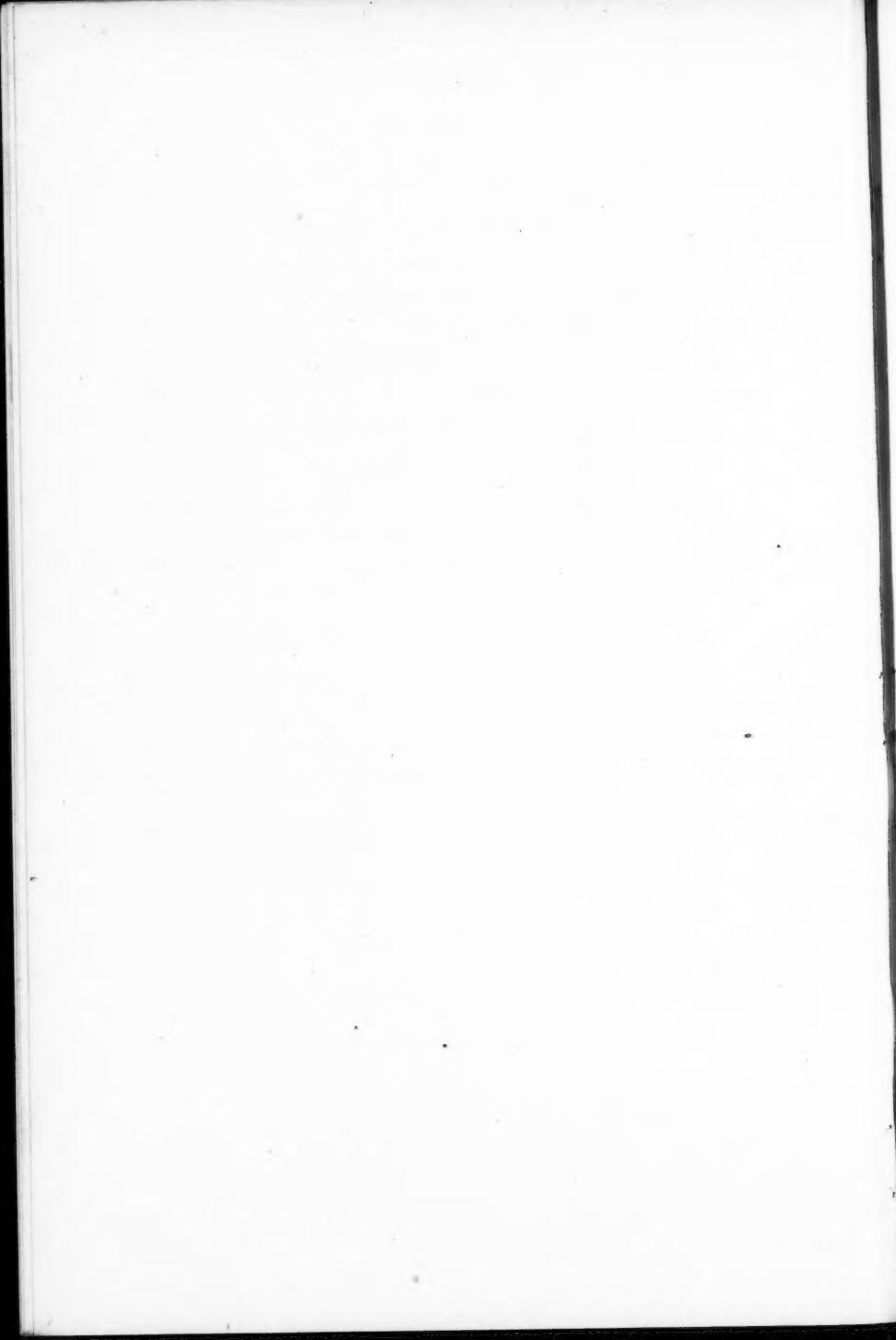
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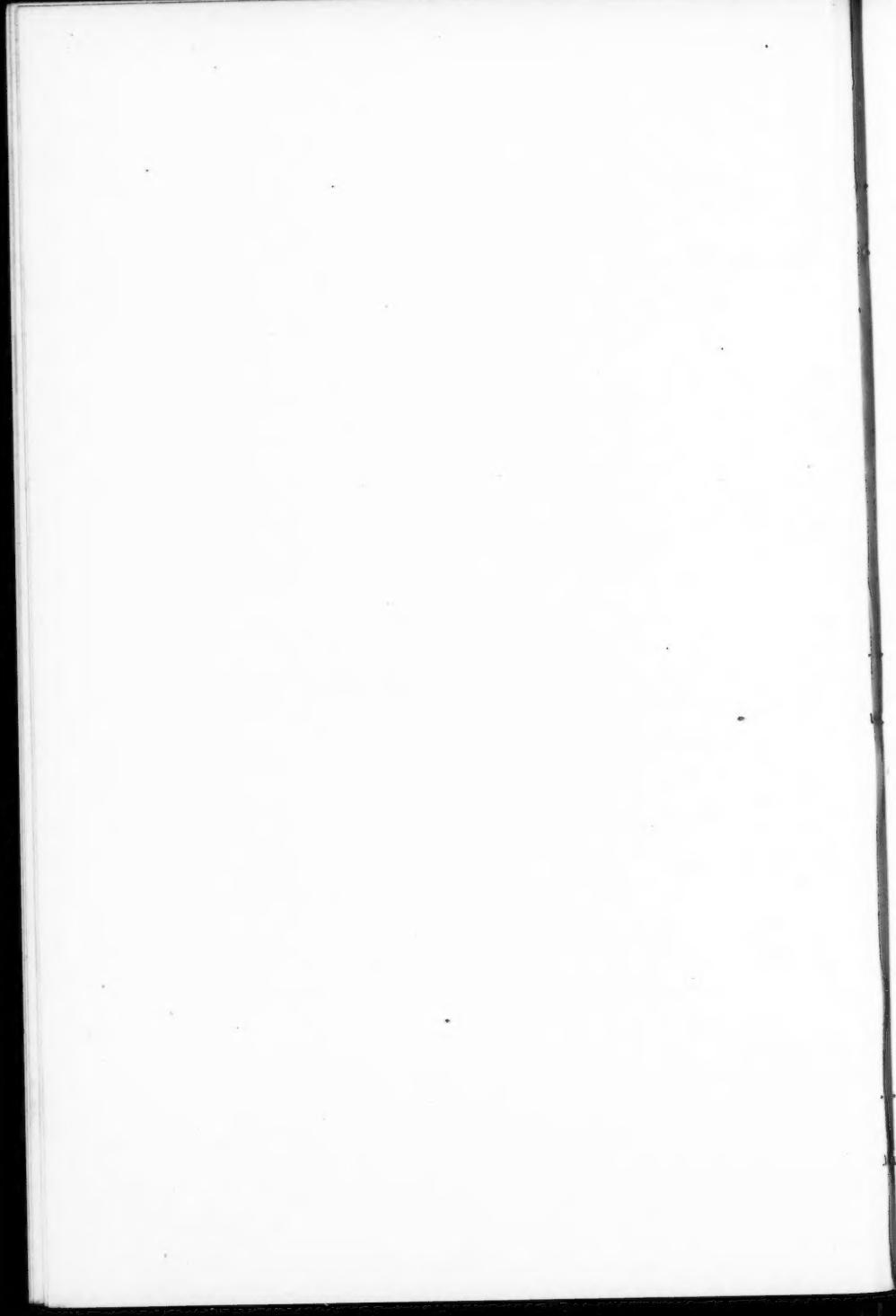
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PART I.

BUSINESS SESSIONS



Transactions of the American Fisheries Society

Monday, September 21, 1908.

Convention called to order at 10 a. m. by the President, Dr. Hugh M. Smith, of Washington, D. C., at the Arlington Hotel, Washington, D. C.

The following program was presented:

"Some Experiments on the Artificial Expression and Fertilization of Gold Fish." JERRY R. BERKHOUSE, Torresdale, Pa.

"Value of Carp as Furnishing Food for Black Bass." DR. S. P. BARTLETT, Quincy, Ill.

"Lobster Culture." PROF. A. D. MEAD, Providence, R. I.

"The Modern Hatching House." SAMUEL F. FULLERTON, St. Paul, Minn.

"The Muskalonge of the Ohio Basin." HON. TARLETON H. BEAN, Albany, N. Y.

"Description of San Marcos Station with Some of the Methods of Propagation in Use at that Station. JOHN L. LEARY, San Marcos, Tex.

"Some Reasons for Failure of Fish Protective Legislation and Some Suggestive Remedies." OREGON MILTON DENNIS, Baltimore, Md.

"Some Points in the Migration of Pacific Salmon as Shown by Its Parasites." PROF. HENRY B. WARD, Lincoln, Neb.

"Gases Dissolved in Waters of Wisconsin Lakes." DR. E. A. BIRGE, Madison, Wis.

"Experiments in Hatching Small-Mouth Black Bass." ROBERT RIPPET, Woodruff, Wis. (Presented by Dr. E. A. Birge.)

"Some Peculiarities in Spawning Habits of Large-Mouth Black Bass." J. J. STRANAHAN, Bullochville, Ga.

(Question Box.)

The President then read his annual address.

President: We are honored today in having with us some of our esteemed honorary and corresponding members, among them

being Mr. Charles E. Fryer, Head Inspector of Fisheries of England; Dr. P. P. C. Hoek, Scientific Fishery Adviser of the Dutch Government; Dr. Decio Vinciguerra, Director of Royal Fish Cultural Station at Rome, and Dr. O. T. Olsen of Grimsby, England, who comes to the International Fisheries Congress as the representative of the Royal Geographical Society. We are exceedingly glad to see these gentlemen with us.

There are quite a large number of applications for membership in the society which have not yet been acted upon, and there may be other applications for membership that have not been reported. I suggest that all applications be presented to a committee and that will enable us to vote on the entire series at one time. The treasurer and secretary will be named as members of this committee, and they can receive any names during the session of the society.

We will now listen to the reports of officers, and first we will have the report of the secretary.

Secretary Peabody: The secretary's report has been printed and sent to every member. There is nothing to add to that report specially.

President: We will then receive the report of the treasurer.

The treasurer then presented his report as follows:

To the American Fisheries Society of the United States of America.

GENTLEMEN:—I herewith submit by Annual Report as Treasurer from July 23, 1907, to September 21, 1908:

RECEIPTS.			
1907.			
July 23—Balance cash on hand.....	\$131.32		
Life membership fees.....	40.00		
Yearly dues.....	616.00		
Reports sold.....	2.00		
		—	\$789.32
1907.	EXPENDITURES.	Voucher No.	
July 31—J. W. Titcomb, postage, etc.....	\$ 4.28	(1)	
Aug. 19—H. T. Leasure, use of lantern.....	5.00	(2)	
Sept. 28—500 stamped envelopes.....	10.72	(3)	
Oct. 19—H. M. Smith, President, postage.....	2.22	(4)	

Oct. 27—Post Pub. Co., etching and letterheads.	10.25	(5)
Oct. 25—Goodwin & McDermot, stenographers.	194.40	(6)
1908.		
Jan. 7—G. F. Peabody, Secretary, reports and envelopes	307.45	(7)
G. F. Peabody, Secretary, postage.....	37.04	
G. F. Peabody, Secretary, services....	25.00	
July 20—International Fishery Congress award.	100.00	(8)
July 25—500 stamped envelopes.....	10.72	(9)
July 28—G. F. Peabody, Secretary, 500 circulars	4.44	(10)
G. F. Peabody, Secretary, postage on reports (omitted in previous year)	34.87	
Sept. 1—Charles G. Atkins, Corresponding Secretary, postage, printing, etc.....	28.44	(11)
Sept. 10—J. C. Hall Co., receipt books.....	6.30	(12)
Sept. 16—G. F. Peabody, Secretary, postage, printing, etc.....	25.64	(13)
G. F. Peabody, Secretary, stenographer's services.....	25.00	

		\$831.77
Balance due Treasurer.....		42.45

		\$831.77

Respectfully submitted,

CHARLES W. WILLARD, Treasurer.

Motion was made by Mr. Root and seconded by Secretary Peabody that the report be referred to an auditing committee to be appointed by the president.

Motion unanimously carried.

President: I will name W. E. Meehan, W. H. Boardman and W. T. Thompson as members of the auditing committee on treasurer's report.

The report of standing committees is the next thing in order. Is the executive committee ready to make report?

Mr. Meehan: Gentlemen, I have the honor to herewith present my report in behalf of the executive committee. At the last meeting of the society two resolutions were adopted, having the same end in view. The first directed the executive committee to get into correspondence with the United States government, the Canadian government, and the governors of the states

bordering on the great lakes, requesting them to appoint delegates to an informal international conference for the purpose of suggesting uniform legislation regarding the fisheries of the great lakes. The second resolution directed the committee to enter into correspondence with the governors of states bordering on the great lakes to endeavor to induce them to assist in having the various legislatures cede to the federal government state control of the great lakes. In conformity with these resolutions, the committee approved a letter on each subject and I forwarded them. The Minister of Marine at Ottawa, the Governor General of Canada, and all the states responded affirmatively in regard to the appointment of delegates to the proposed informal international conference. Nearly all the governors responded favorably concerning federal control. The secretary of state of the national government was the only one corresponded with who declined to appoint a delegate, apparently misunderstanding the purport of the letter, because he gave as his reason for refusing that previous efforts to secure uniform legislation had been futile.

As chairman of the executive committee, I then made arrangements for a personal interview with the secretary of state, but an illness intervened. On my recovery I was officially notified that a treaty had been signed between Great Britain and the United States by which the two governments would take control of the great lakes, and I was informally informed that state action would not be necessary, that a commission representing the Canadian government and the United States government had been formed for the purpose of examining conditions on the great lakes and suggesting a bill to be introduced into congress and the Canadian parliament simultaneously with the ratification of the treaty to regulate the fisheries. Under the circumstances I did not pursue the matter any further with either the governors or the secretary of state at Washington.

Subsequently, in June of this year, I was wired by the International Fisheries Commission, referred to in the former paragraph, to meet them at Erie. I did so and at their request gave them the conditions which prevailed in Pennsylvania, or that part of Lake Erie under the jurisdiction of Pennsylvania. With me at the time was the commissioner from Ohio, Mr. Paul

North, and in company with the commission went as far as Ash-
tabula, O.

The committee takes pleasure, therefore, in reporting that the great object for which it adopted resolutions in 1907, namely, federal control of the great lakes seems to be on the point of accomplishment. Only the ratification of the treaty and the enactment of legislation remains as far as we are aware.

Very little other work fell to the lot of the committee during the year. Only the usual letters offering badges for stenographic work.

The report was then received and placed on file.

President: Will Mr. Atkins make a brief statement on behalf of the standing committee on foreign relations?

Mr. Charles G. Atkins, East Orland, Me: In view of the International Congress of Fisheries meeting here in Washington, D. C., and the abundant opportunity we shall have in that congress and the reports made of it to consider the subject of foreign fisheries and fish culture in all its bearings, it was thought best by your committee to omit for the present year the preparation and presentation of any formal report for publication, and your committee therefore beg you to excuse them until next year.

President: Mr. Atkins' statement will be received and noted.

The president will appoint as committee on nomination of officers for the ensuing year:

Hon. George M. Bowers, representing the United States at large.

Mr. William P. Morton, Rhode Island.

Mr. R. Tyson White, New York.

Mr. A. R. Whitaker, Pennsylvania.

Mr. James Nevin, Wisconsin.

The president will also appoint as members of the committee on time and place of next meeting:

Dr. James A. Henshall, Montana.

Mr. Henry T. Root, Rhode Island.

Dr. T. S. Palmer, Washington, D. C.

The president will now appoint the committee on behalf of

the society to represent it at the International Fisheries Congress. The chair has the pleasure in announcing this committee which he has endeavored to have composed of members who would not go to the Fisheries Congress in any other capacity:

Mr. Seymour Bower, Michigan;
Mr. James Cruickshank, New York;
Dr. James A. Henshall, Montana;
Mr. H. F. Hurlbut, Massachusetts;
Mr. Edwin A. Newman, District of Columbia.

Mr. John W. Titecomb, Washington, D. C.: May I inquire if any definite program is arranged for the day?

President: The arrangement of the program was necessarily deferred until the members arrived. We shall give preference to those who are present with reference to the reading of papers. I will appoint on that committee the following:

Mr. Barton A. Bean,
Mr. Ward T. Bower,
Mr. I. H. Dunlay,
Mr. J. Frank Ellis,
Mr. B. W. Evermann,
Mr. W. P. Hay,
Mr. H. P. Moore,
Mr. T. S. Palmer, and
Mr. Henry Talbott.

Mr. Titcomb: Will there be three sessions today?

President: There will be two sessions at least today.

Mr. Titecomb: I make inquiry for the reason that people are telephoning to me about the matter.

Dr. H. C. Bumpus, New York City: In view of there being present those who have come to Washington to attend two different meetings, namely, that of the American Fisheries Society and that of the Fourth International Fishery Congress, as president of the congress, I would say that our first meeting, at which Hon. George M. Bowers, United States Commissioner of Fish-

eries, will preside, will be held in the hall of the National Geographic Society, Sixteenth and M streets, N. W. Hon Oscar S. Straus, Secretary of Commerce and Labor, will deliver an address of welcome on behalf of the United States Government; Hon. Henry L. West, Commissioner of the District of Columbia, will welcome the members to the city of Washington; and Dr. Hugh M. Smith, President of the American Fisheries Society, will extend a greeting on behalf of the society. A response in the name of the foreign members will be made by Dr. P. P. C. Hoek, Scientific Fishery Adviser of the Dutch Government.

All members of the American Fisheries Society are invited to become members of the International Fishery Congress and to partake in the discussions. Application for membership may be made to Mr. Frank M. Clark or to Mr. Ward Bower. The program for the International Congress is one that extends through the week until Friday night and continues on Monday of next week in New York, on Tuesday in Narragansett Bay, Wednesday in Woods Hole, Thursday in Boston, and Friday and Saturday in Gloucester. The program both in Washington for this week and outside of Washington for next week is an exceedingly interesting one, and I think that the members of the American Fisheries Society will without exception identify themselves with this important gathering.

President: I would like to supplement Dr. Bumpus' remarks by saying that the foreign delegates to the International Fisheries Congress, and other members of the congress also will please assemble in the diplomatic room at the state department at 9:30 o'clock tomorrow. There they will be received by the Secretary of State, and will proceed thence to the meeting hall, where the opening meeting will be held at 10:30 o'clock instead of 10 o'clock. I may say that the programs in detail for the meetings of the International Congress will be distributed here and at the headquarters at the New Willard Hotel, this afternoon.

Mr. Titecomb: In view of the fact that there are some here who desire to join the American Fisheries Society, would it not be well to elect those who have already made application and have them registered?

President: The treasurer will please read the names of those who have been proposed for membership.

Treasurer: The following names have been presented for membership:

Adams, Oliver, *55 Glen Road, Toronto, Ont.*
Aller, H. D., *Beaufort, N. C.*
Anderson, August J., *Marquette, Mich.*
Baird, George W., (Admiral), *Washington, D. C.*
Barrows, A. L., *Cavite, Philippine Islands.*
Bliss, H. C., (*Alaska Packers' Association*), *Atlanta, Ga.*
Burgess, F. S., *Hammond Bldg., Detroit, Mich.*
Canty, J. C., *Galveston, Texas.*
Carleton, L. T., *Maine Fish and Game Com., Augusta, Me.*
Catte, Eugene, *Langdon, Kas.*
Crandall, A. J., (*Mgr. Ashaway Line & Twine Co.*), *Ashaway, R. I.*
Crary, F. C., *Hudson, Wis.*
Culler, C. F., *Wytheville, Va.*
Detwiler, John Y., (*Pres. Fla. Fish Com.*), *New Smyrna, Fla.*
Dewitt, R. E., *St. Joseph, Mo.*
Dorr, W. C., (*Alaska Packers' Association*), *San Francisco, Cal.*
Dornbos, H. J., *Grand Haven, Mich.*
Farr, E. D., (*G. and F. Comr.*), *Denver, Colo.*
Glennan, J. J., (*B. F.*), *Washington, D. C.*
Goodwin, H. D., *Milwaukee, Wis.*
Gorham, Wm. B., (*Fish Culturist*), *Erwin, Tenn.*
Hannah, Robert, *Fergus Falls, Minn.*
Heinrichs, Henry J., (*Keystone Fish Co.*), *Erie, Pa.*
Hafer, A. W., *Bellefonte, Pa.*
Hemingway, E. D., *123 Rochelle Ave., Wissabrikon, Philadelphia, Pa.*
Jaggard, E. A., (*Judge*), *St. Paul, Minn.*
Jordan, E. C., (*Northampton Co.*), *Cheriton, Va.*

Jordan, George C., (*Equitable Life Ins. Society*), Washington, D. C.

Kavanagh, A. J., (*B. F.*), Leadville, Colo.

Kellogg, Prof. James L., (*Williams College*), Williamstown, Mass.

Kilpatrick, Chas. M., (*Station F.*), Minneapolis, Minn.

Kincaid, W. S., (*State Supt.*), Denver, Colo.

Lay, Charles, Sandusky, O.

Libby, T. E., Vinal Haven, Me.

Light, R. M., (*Colo. Fish Com.*), Denver, Colo.

McAllister, H. C., (*Master Fish Warden*), Portland, Ore.

McDonald, Miss Rose, (*B. F.*), Washington, D. C.

Meekins, Theo. S., Manteo, N. C.

Miller, Frank M., 605 Maison Blancher Bldg., New Orleans, La.

Mowbray, Louis L., Hamilton, Bermuda.

Nesley, Chas. H., (*Dept. Fisheries*), Harrisburg, Pa.

Pratt, Joseph Hyde, Ph. D., Chapel Hill, N. C.

Prince, Hon. E. E., (*Dominion Com. of Fisheries*), Ottawa, Canada.

Saunders, J. P., (*Supt.*), Deerwood, Minn.

Scully, J. S., (*The Burlington*), Washington, D. C.

Shiras, Geo., (32 Stonelaigh Court), Washington, D. C.

Smith, Richard, Waukegan, Ill.

Speaks, John C., (*Chief Game Warden*), Columbus, O.

Stiles, Robert, Sultan, Wash.

Stone, J. W., (*State Fish Warden*), Madison, Wis.

Thomison, G. H., (*Fish Culturist*), Estes Park, Colo.

Wallace, John H., Jr., Montgomery, Ala.

Webb, W. M., Morehead, N. D.

Webster, H. A., Oregon City, Ore.

Wessel, Joseph A., Crookston, Minn.

CORRESPONDING MEMBERS.

Higginson, Edwardo, (*Consul for Peru*), New York City.

Poiteau, M. Charley, Lommel, Belgium.

LIFE MEMBER.

Dominy, Jeremiah M., *South Haven, L. I.*

HONORARY MEMBERS

Von Kadich, Dr. Heinrich, *Department of Forestry and Domain, Vienna, Austria.*

Kitahara, Dr. Tasaku, *Imperial Fisheries Bureau, Tokyo, Japan.*

Antipa, Prof. Dr. Gregoire, *Inspector General of Fisheries, Bucharest, Roumania.*

Nordquist, Dr. Oscar Fritiof, *Superintendent of Fisheries, Lund, Sweden.*

The committee on membership recommend and move the election of these applicants.

Motion seconded by Mr. Meehan.

Unanimously carried.

Motion made that the secretary cast the ballot of the society, electing the applicants to membership.

So done.

Mr. John L. Leary of San Marcos, Texas, then read a paper, "Description of San Marcos Station With Some of the Methods of Propagation In Use at That Station."

President: We will now listen to the report of the auditing committee.

Mr. W. E. Meehan: We have examined the report of the treasurer together with the vouchers and found the same correct and recommend the adoption of the report.

The auditing committee's report is signed by the full committee.

We think that the treasurer should be thanked for the manner in which he has conducted his office.

Motion made, seconded and unanimously carried, adopting the report.

President: I will appoint the following committee on resolutions:

W. E. Meehan,
S. W. Downing,

Samuel F. Fullerton,
Charles G. Atkins,
Seymour Bower.

Mr. Meehan: I suggest that any members who have resolutions hand them to any member of the committee so that we can pass on them at the earliest possible moment.

The secretary then read a paper by Chester K. Green, of Cape Vincent, N. Y., on the subject of "The Increase of White Fish and Lake Trout in Lake Ontario."

Mr. Frank N. Clark, Northville, Mich.: Mr. President, as you appointed me one of the committee to consult members of this society to see if they wished to unite with the International Congress, I have seen most of them. I have checked off from the list of attendance all those that I have seen. There are several that I have not seen, and if they will hand the names in we will be glad to have them unite. The idea of the president was to hand these names in to the International Congress as applicants for membership from the American Fisheries Society. We wish to make this list as complete, before morning, as possible.

The registered attendance at the meetings of the society is as follows:

Alford, J., *Madison, Wis.*
Atkins, Chas. G., *East Orland, Me.*
Avery, Carlos, *Hutchinson, Minn.*
Baird, Admiral Geo. W., *Washington, D. C.*
Baldwin, O. N., *Leadville, Colo.*
Bartlett, Dr. S. P. *Quincy, Ill.*
Bean, Barton A., *Washington, D. C.*
Bean, Dr. Tarleton, H., *Albany, N. Y.*
Berkhaus, J. R., *Torresdale, Philadelphia, Pa.*
Bickmore, Prof. G. S., *Washington, D. C.*
Birge, E. A., *Madison, Wis.*
Bliss, H. C., *Atlanta, Ga.*
Boardman, W. H., *Central Falls, R. I.*
Booth, D. C., *Spearfish, S. D.*
Bowers, Hon. George M., *Washington, D. C.*
Bower, Seymour, *Detroit, Mich.*

Bower, Ward T., *Washington, D. C.*
Brown, Hon. George M., *Detroit, Mich.*
Buck, W. O., *Grand Lake Stream, Me.*
Buller, A. G., *Union City, Pa.*
Buller, H. M., *Bellefonte, Pa.*
Buller, Wm., *Corry, Pa.*
Bumpus, Dr. H. C., *New York.*
Carter, E. N., *St. Johnsbury, Vt.*
Clark, Frank N., *Northville, Mich.*
Crampton, John M., *New Haven, Conn.*
Cogswell, Theo. M., *Washington, D. C.*
Coker, Dr. Robert E., *Johns Hopkins Univ., Baltimore, Md.*
Conway, R. J., *Belle Isle, Detroit, Mich.*
Dean, H. D., *Neosho, Mo.*
Dinsmore, A. H., *Birdsview, Wash.*
Downing, S. W., *Put-in-Bay, O.*
Ellis, J. Frank, *Washington, D. C.*
Evans, A. Kelly, *Toronto, Canada.*
Evans, Barton D., *Harrisburg, Pa.*
Evermann, Barton W., (*Bureau of Fisheries*), *Washington, D. C.*
Fryer, Chas. E., (*Inspector of Fisheries*), *England.*
Fullerton, S. F., *St. Paul, Minn.*
Geer, E. Hart, *Hadlyne, Conn.*
Gill, Dr. Theo., *Smithsonian Institute, Washington, D. C.*
Glenmare, J. J., (*Bureau of Fisheries*), *Ill.*
Goodwin, H. D., *Milwaukee, Wis.*
Green, Chester K., *Cape Vincent, N. Y.*
Haas, Wm. T., *Spruce Creek, Pa.*
Harron, L. G., *Washington, D. C.*
Henshall, Dr. J. A., *Bozeman, Mont.*
Hoek, Dr. P. P. C., (*Scientific Fishery Adviser*), *Holland.*
Hurlbut, W. F., *East Freetown, Mass.*
Jennings, G. E., *New York.*
Keesecker, A. G., (*Supt. B. of F.*), *Erwin, Tenn.*

Kitahara, T., (*Expert of Fisheries Dept. of Agriculture and Commerce*), *Tokyo, Japan.*

Lambson, G. H., *Baird, Cal.*

Lay, Charles, *Sandusky, O.*

Leary, John L., *San Marcos, Tex.*

Lydell, Dwight, *Mill Creek, Mich.*

Mathewson, Geo. T., *Thompsonville, Conn.*

Meehan, W. E., (*Supt. of Ohio Station*), *Put-in-Bay, O.*

Morton, Wm. P., *Providence, R. I.*

Nesley, Chas. H., *Harrisburg, Pa.*

Nevin, Jas., *Madison, Wis.*

Nordquist, Dr. Oscar, *Lund, Sweden.*

O'Malley, Henry, *Oregon City, Oregon.*

Olsen, O. T., *Grimsby, England.*

Palmer, Dr. T. S., (*Dept. of Agriculture*), *Washington, D. C.*

Peabody, Geo. F., *Appleton, Wis.*

Peoples, Hiram, *New Providence, Pa.*

Race, E. E., *Green Lake, Me.*

Rankin, Jas. F., *South Charleston, O.*

Roberts, A. D., *Woonsocket, R. I.*

Robinson, Robert K., *White Sulphur Springs, W. Va.*

Root, Henry T., *Providence, R. I.*

Safford, W. H., *Conneaut Lake, Pa.*

Seagle, George A., *Wytheville, Va.*

Sellers, M. G., *Philadelphia, Pa.*

Smith, Dr. Hugh M., *Washington, D. C.*

Sumner, F. B., *Woods Hole, Mass.*

Surber, Thad., *White Sulphur Springs, W. Va.*

Stapleton, M. F., *Mammoth Spring, Ark.*

Stone, J. W., *Madison, Wis.*

Thompson, W. T., *Leadville, Colo.*

Titcomb, J. W., *Washington, D. C.*

Vinciguerra, Dr. Decio, (*Royal Fish Cultural Station*), *Rome, Italy.*

Wallich, Claudius, *Afognak, Alaska.*
Ward, Dr. Henry B., (*Univ. of Neb.*), *Lincoln, Neb.*
Webster, B. C., *Bellefonte, Pa.*
White, R. Tyson, *Brooklyn, N. Y.*
Willard, C. W., *Westerly, R. I.*
Wilson, C. H., *Glens Falls, N. Y.*
Whitaker, Andrew R., *Phoenixville, Pa.*
Worth, F. G., *Beaufort, N. C.*

Adjourned until 2 p. m., same day and place.

Same place, Monday, September 21, 1908, 2 p. m.

Meeting called to order by the president.

Dr. S. P. Bartlett of Quincy, Ill., presented a paper on the subject of the "Value of Carp as Furnishing Food for Black Bass," which paper was read by Secretary Peabody, at the request of Dr. Bartlett. The paper was discussed.

President: We will now receive the report of the committee on nominations, which will be presented by the chairman, Mr. Seymour Bower.

Mr. Bower: The committee appointed to select officers for the American Fisheries Society for 1908 and 1909, beg leave to submit the following recommendations:

President—Dr. Tarleton H. Bean, Albany, N. Y.

Vice President—Seymour Bower, Detroit, Mich.

Recording Secretary—George F. Peabody, Appleton, Wis.

Corresponding Secretary—Charles G. Atkins, East Orland, Me.

Treasurer—C. W. Willard, Westerly, R. I.

Chairman Executive Committee—William E. Meehan, Harrisburg, Pa.

Members of Executive Committee:

S. F. Fullerton, St. Paul, Minn.

Frank Miller, Put-in-Bay, O.

G. W. Field, Boston, Mass.

W. P. Morton, Providence, R. I.

George T. Mathewson, Enfield, Conn.

Jabe Alford, Madison, Wis.

Motion made, seconded and unanimously carried adopting the report and electing the officers.

Prof. Henry B. Ward of Lincoln, Neb., then read a paper on the subject of "Some Points in the Migration of Pacific Salmon as Shown by Its Parasites," which paper was fully discussed.

President: The secretary will now read a communication from Mr. Joslyn, a former president of the society.

Detroit, Mich., Sept. 21st, 1908.

Dr. Hugh M. Smith,

President American Fisheries Society,

Washington, D. C.

Greatly disappointed, but I cannot be there; expected to until last week. I have no doubt that the meeting will be enjoyable and valuable to us all.

C. D. JOSLYN.

Secretary: Most of the members are acquainted with Prof. Joslyn, and will appreciate his efforts to be here.

I will read the following resolution which has been presented by Dr. Smith:

Resolved by the American Fisheries Society in annual meeting assembled, That we have learned with pleasure of the conclusion of a treaty between the United States and Great Britain by which the fishery question affecting the operations of the United States fisheries on the coast of British North American provinces will be submitted to arbitration.

Resolved, That the conclusion of a convention between the United States and Great Britain by which the regulation of the fisheries of the contiguous waters of the United States and Canada will be assumed by the two federal government, marks a distinct epoch in the history of American fisheries, and we pledge our official and personal efforts to facilitate the work of the International Fisheries Commission appointed under this convention.

Mr. Fullerton: Should it not be referred to the committee on resolutions?

President: It was brought up at this time in order that anyone might discuss it if necessary. Does Dr. Evermann want to speak on that?

Dr. Evermann: If it is to be referred to a committee perhaps there will be opportunity for discussion hereafter.

President: There will be such opportunity and the resolution will be referred to the committee on resolutions.

The chair would like to call upon a highly esteemed corresponding member of the society, who comes to us in person at this meeting, and desires to offer a proposition for our consideration, Dr. O. T. Olsen of Grimsby, England. (Great applause.)

Dr. Olsen: Mr. President and gentlemen, I rise with pleasure at your call. You were good enough to have my proposition read last year, and it is a proposition for an International Fisheries Society to be formed with a view of consolidating results of progress made in the fisheries world. I think when we have such gatherings as these we often forget many important points. Sometimes they are not recorded, and at other times they are shelved. But by having a society formed which would be a permanent one, and which would gather up all information that is brought to bear upon the fishery world, then I think much good could be done.

The few points which I enumerate are these:

The natural history of fishes, their use as human food, their migration and habits. That is one thing that we ought to study in order to trace the fish. I am speaking now more particularly of salt water fish as we have very little to do with fresh water fish in England, not having many rivers where they cultivate them.

The second is the means of catching, preserving and transporting fish—also for salt water fish.

Oceanography, the physical condition of the sea, the tidal effects, and also artificial hatching of salt water fish.

The fishery laws, determining the nationality of the fishing vessels of the sea, etc.; their appliances and the qualifications of skippers and mates, as well as the crew; their examination showing competency, and other matters; and last, but not least, territorial limits which have been a bone of contention in England for some years now.

There is an international convention formed which sat at The Hague in 1883. This convention formulated a certain code of rules and laws, and we have police patrolling the fisheries of

the North Sea, from different nations, and these police have done exceedingly good work. If for nothing else, there is one thing for which they deserve praise, and that is stopping the sale of spirits to the fishermen in the North Sea, and now I am pleased to say that these boats have been actually exterminated, and the mission to deep sea fishermen has taken up the selling of tobacco at sea, for that used to be the loop-hole—they had to get tobacco, but instead of that they got spirits. Now the tobacco is supplied at a shilling a pound from mission boats.

Now this proposition for an international society was read here last year at your meeting, and at the same time I read it in Belgium at a fisheries congress there, and it was approved, and we were to have started it there. But a certain government official wanted to formulate a code of rules first and send them over to me for correction. He has failed thus far in doing so, but they have formulated another document, and I have a translation of it here, but that does not meet the point. It is not for any country or any one individual or committee to say where that document shall be kept; it is for the members to whom it belongs. Now when the society is formed, it is then time enough to find a locker to put the document in, but I would like to have this launched in the greatest country in the world, and especially the United States of America, where you have the largest inland fisheries in the world, and you are able and I believe willing to extend your knowledge to the different countries that require such information. At the same time I think that I dare say both on behalf of England and on behalf of other states of Europe, that they will be willing to reciprocate kindnesses by giving information relating to salt water fisheries which are not carried out to a great extent in America, except by lines. We have what we call the beam-trawl and also the auto-trawl, and those fisheries are very productive, and I think that the Canadians and also the people of the United States will be taking up trawling after ground fish.

My proposition is now, that a committee be appointed to start this society at this meeting. If anybody wishes to assist in the matter I should be highly gratified. Perhaps the president will say a word more about it. (Applause.)

President: I think we appreciate the importance of the matter that Dr. Olsen has brought up. I would suggest that he put his proposition in writing and that it be referred to the committee on resolutions for an expression of an opinion on behalf of the society.

Secretary: A matter that has been overlooked for a moment is a communication from Daniel B. Fearing of Newport, R. I. He wishes to propose as a life member Jeremiah M. Dominy, postmaster of South Haven, Long Island, and superintendent of the Suffolk Club, at the same place. Mr. Fearing has written me requesting that the American Fisheries Society be asked if any one has had any personal experience in stocking waters with striped bass, and something regarding the cost of doing this work. If there is anyone that could offer information on that point it would be perhaps, very valuable to the society as well as to Mr. Fearing, and I would present Mr. Dominy as a life member, for your vote.

Mr. Willard: The name of Mr. Dominy was presented in like manner last year and voted upon and he was elected a member.

President: Mr. Fearing is a member of this society whom very few of us have had the pleasure of meeting. He has the largest private library of fish and fishery literature in the United States, at his home in Newport, and is an enthusiastic member of this society, although he is prevented from attending its meetings. I would like to ask some of the gentlemen engaged in cultivation of striped bass whether they cannot answer Mr. Fearing's inquiry. The question is as to stocking new waters with striped bass.

This question was then taken up and discussed.

Mr. Titecomb: Now I should like to have the society consider again through its very efficient committee, who two or three years ago designated the sizes of fish by numbers, to take up that question and to designate more definitely those sizes. To illustrate what I mean, for those who were not present: you recall that the society decided that a fish from one to two inches in length should be called a number one fingerling; and from two

inches long up to three inches, a number two fingerling, and so on. Now you take a fish one inch long and compare it with a fish one and seven-eighths inches long, both are number one fingerlings, but there is too much discrepancy in the size. You can transport twice as many, I can safely say, of the one-inch fish, as you can carry of the fish one and seven-eighths inches in length. You take the two-inch fish as compared with the fish two and seven-eighths inches in length (I merely use those figures for illustration) and you will find the same discrepancy. It is difficult to make up a table. For instance you cannot say that you will carry a definite number of number one fingerling or number two fingerling to a regulation transportation can of water, because there is such a tremendous difference in the size. Here is a fish called a number three fingerling which is a trout three and seven-eighths inches in length, which I exhibit to you. Here is another three inches in length. One fish which I exhibit will weigh three times what this second fish will weigh, yet they are both number three fingerlings. You take the number one and there is more difference proportionately in weight between the number one which is an inch long and the number one which is one and seven-eighths inches in length. It seems to me we have got to have some intermediate numbering or half numbers to properly designate our fish in order to tell what we are distributing. You tell a man he is getting number three fingerlings and they may be three and seven-eighths inches long, but he expects a thousand number three, and you cannot carry of that size more than one hundred and twenty-five to a can, whereas of the fish just three inches long you can carry three hundred or even four hundred. I should like to have that committee take that question up and thresh it out and take for illustration these fish which I exhibit to you.

President: If there is no objection this question of renaming of fishes, such as are artificially cultivated, with reference to their size, will be referred to the same committee, with instructions to report at the next meeting.

Mr. Frank N. Clark, Northville, Mich.: I think I was one of that committee, but we were discharged as I understood it.

We made our report finally and that committee is not in existence.

Mr. Henry T. Root, Providence, R. I.: Mr. Clark was chairman and Mr. Seymour Bower was one of the other members.

President: The proper procedure would be to reappoint the committee or appoint another committee, whichever the society directs.

Mr. W. T. Thompson, Leadville, Colo.: I move that the members of that committee be authorized to take that matter up.

President: Is it the pleasure of the society that this same committee be reappointed with instructions to consider this matter at this session and make report before adjournment? Four of the five members are present and it would be possible for them to get together and consider this question.

Mr. Clark: Do I understand this committee is again appointed.

President: It will be if the society so directs.

It is moved and seconded that a committee, consisting as far as possible of the former members, be appointed.

Mr. Titecomb: I suggest that Dr. Bartlett be added to that committee in place of Mr. Whish, who is absent.

Motion seconded and unanimously carried.

President: The committee consists of Messrs. Frank N. Clark, W. E. Meehan, John D. Whish, S. P. Bartlett, and H. M. Smith.

Mr. Clark: May I just say a word on the subject?

President: Certainly.

Mr. Clark: This committee took two years to settle this question when it was before them formerly. Now you propose to have them report at another session of this meeting, and I understand you are going to try to get through today. After working upon this plan for several years it does not seem to be exactly satisfactory even though two years were spent in settling the question. Now you want it settled in a few hours, and I

most strenuously object. I object to acting on that committee in any manner like that and settling it. I do not think it could be done. If it is not right, very well, I am willing to serve on the committee as long as I may live, if you want me to, but I do not want to act upon the committee and settle the question in two hours, after working two years to fix upon a certain definite system.

Dr. Bartlett: It seems to me passing strange that a body of men such as we have here interested in that feature, who have had two years' experience on that line, cannot settle the matter in a very short time. I am interested in this matter. I telegraph to my superiors that I have made a shipment of so many number ones and so many number twos, but when I get up to the sixes and sevens the variation in rate is increasing all the time. The number that goes forward in cans does not tally with the number represented in my shipping card. It must be a matter of a good deal of inconvenience, and I think in three of four hours we could reach a conclusion. We might have intermediate numbers and arrive a little closer at the truth. We have had two years' experience to base our decision on.

Mr. Clark: We have had two years' experience and I am pretty well satisfied with the present plan. You may get up any plan—I don't care what it is—it will vary unless you get it into eighths. When bass will grow five-eighths of an inch in three days, what are you going to do? I think the system is pretty good as it is now, and if the committee attempt to do anything now I will argue along that line. I really think it is a mistake. Dr. Bartlett may be all fixed and satisfied in his mind, and Mr. Meehan may be (I don't think you have got the personnel of the committee as it was before, exactly) and they may know just what to do and say, but it seems to me it is too short a time to try to arrive at any satisfactory conclusion.

Mr. Titecomb: I rise to a point of order. I think the matter should be discussed in committee, not here.

Mr. Root: I don't think the chairman has the names of the committee just as it was before.

President: The president mentioned them from memory, and doubtless possibly made some mistake. I would be glad to be corrected.

Mr. Root: I do not think I was on that committee.

Mr. Clark: Do I understand the committee is supposed to act or report at this meeting?

President: The committee is without instructions.

Mr. Clark: Without instructions—thank you.

President: —As yet. (Laughter.)

If there is no further discussion the report will be made at the discretion of the committee, unless the society otherwise orders.

The chair will call upon the committee appointed to consider the time and place of next meeting,

Dr. J. A. Henshall, Bozeman, Mont.: Mr. President, the committee has entertained and considered a number of places proposed by different members, and have come to the conclusion unanimously to recommend that the society meet on the 12th of July, 1909, at the Mammoth Hot Springs Hotel, in the Yellowstone National Park.

Mr. Seymour Bower: The resolutions committee now have a resolution under consideration to fix the time of meeting of our annual meeting in September, instead of July, and I suggest that we decide upon a place of meeting at this time and not on the time, because we will undoubtedly bring in a report recommending that we meet in September instead of July, provided we find it does not conflict with the constitution and by-laws.

Dr. Henshall: I would say September would be too late for the Yellowstone National Park.

Mr. Clark: I would suggest that Mr. Titcomb be added to this committee and make such motion if it is in order.

President: He will be appointed on the committee if there is no objection.

There is no provision of the constitution or by-laws fixing

the time when the meetings of the society shall be held. It can be determined at each meeting before the subsequent meeting.

Mr. W. P. Thompson, Leadville, Colo.: I think there were particular reasons why the meeting for the coming year should be fixed at an early date, as that is the best time to see the work in the National Park. I hoped that Mr. Booth would have made some remarks along that line, but I would move that the report of the committee be adopted as to time and place, and then whatever date the committee on resolutions might fix would be for future meetings and not the next meeting.

Mr. Titcomb: I hope that matter will be allowed to rest a little while. I realize that we cannot see the fish cultural work in the park unless we go there as early as the 12th of July, but we have, some of us, other work that it is pretty hard to leave at that time, and I think we should give that a little more consideration, as suggested by Mr. Bower. I am heartily in favor of the park and I would like to have you see the trout spawning there. Suppose you let it go until this evening.

President: The report of the committee on time and place of meeting is still before you.

Mr. Titcomb: If we are going to have a session tonight I move to lay it on the table temporarily.

Motion seconded and unanimously carried.

President: The chair has been waiting for some statement from the chairman of this committee to the effect that the time selected had special reference to the absence of road agents from the park. (Laughter.)

We will proceed with the reading of papers, if the society so desires, and I have great pleasure in calling on Dr. Theodore Gill of the Smithsonian Institution, for remarks on the "Spawning of the Common Eel," a subject that has great popular and technical interest.

Dr. Gill then addressed the society on the subject of "The Life History of the Common Eel," and the address was fully discussed.

Mr. Clark: I wish to state that the committee will hold a

public hearing for all those who desire to be heard on the subject of the naming of fish of different size, and I desire the stenographer to be present to make a report of the hearing.

Mr. W. E. Meehan: I hope that the committee will allow a few minutes for the resolutions committee to finish up its work.

Dr. J. A. Henshall, Bozeman, Mont.: Most of the talk has been on the generation and propagation of fishes, but in the interest of the protection of fish, which I deem of equal importance, I desire to present the following resolution:

Whereas, In the irrigating canals already constructed by the United States Government in the western states there is no provision made for the preservation and protection of fish, either by screening the canals and ditches, or by the erection of fishways in the dams connected therewith; and

Whereas, The Government contemplates still more extensive systems of reclamation of arid lands, by the building of storage reservoirs in the mountain gulches, and by the construction of irrigating canals of great length and capacity that are to be supplied with water from flowing streams; therefore be it

Resolved, That a memorial be presented by this Society to the Congress, asking for such legislation as will provide fishways wherever practicable in all dams connected with the work of reclamation of arid lands; and also to provide for the installation of some effective device at the intake of all canals and ditches in connection with said work, in order to prevent fish from entering them.

Resolution referred to resolutions committee.

Dr. E. A. Birge, Madison, Wis.: I have two brief papers prepared by those working in connection with the Wisconsin Geological Survey and Fish Commissioners.

The first is on the subject of "The Tullibee as a Fish of Economic Importance".

Dr. Birge then read the paper which was discussed.

President: I will call on Prof. E. A. Birge of Madison for another paper which he will kindly present, on the subject of "Experiments in Rearing Small-Mouth Black Bass," by Robert Ripple, in charge of hatchery, Minoqua, Wis.

Prof. Birge: The paper was prepared by Robert Ripple, who

is in charge of the Minoqua Hatchery, and records experiments in artificial nests for small-mouth black bass.

Prof. Birge then read the paper which was discussed.

President: We will now listen to the report of the committee on resolutions by Mr. W. E. Meehan.

Mr. Meehan: The committee on resolutions present the following preliminary report:

Whereas, The International Fisheries Congress is to immediately begin its session, and during the period that the Fisheries Congress meets a meeting of the American Fisheries Society has been called; and

Whereas, The objects of this Congress are identical with those of the Society,

Resolved, That, beginning on the morning of September 22, the American Fisheries Society identify itself with the International Fisheries Congress and attend its meetings, and recommend and urge that as many as possible become members. It is further

Resolved, That when the Society adjourns after its final session of today, it adjourns subject to the call of the President any time during the present week.

This resolution is signed by the committee.

Mr. Sam F. Fullerton, St. Paul, Minn.: I move that the resolution be adopted.

Motion seconded and unanimously carried.

A recess was here taken until 8 o'clock p. m., same day and place.

Same day, September 21, 1908, 8 o'clock p. m., same place.

Meeting called to order in the absence of the president, by Mr. W. E. Meehan, Harrisburg, Pa.

President (Mr. Meehan): Owing to the fact that my handwriting is poor and I am requested to proceed with the reading of the resolutions of the resolutions committee, myself.

The first resolution is as follows:

Resolved, That the Society announce meetings to be held in the month of September in the future instead of July.

This resolution the committee marks "not approved," the

constitution not providing any regular date, as it is, and the matter may therefore be left in the hands of the committee on location.

Mr. Frank N. Clark: I move that the report of the resolutions committee be adopted.

Motion seconded and unanimously carried.

President Mr. Meehan): The next resolution is, first in the form of a letter, which is as follows:

The Estes Park Improvement and Protective Association.
Estes Park, Colo., Sept. 16, 1908.

Mr. President and Members of the American Fisheries Society:

GENTLEMEN:—There is one matter that I should like very much to bring before your convention which seems to me of more than passing importance, "At least it is to the undersized fish." Our fish laws provide a "size limit" for fishing, and yet they say nothing about how to handle a fish in taking it off the hook in order to save its life. It does not seem to be generally known, and yet it is nevertheless a fact, that if a fish is grasped with a dry hand in removing it from the hook, that the dry hand will remove the slime from the back of the fish, and while it will swim off it will eventually die from fungus; while if the hand is moistened this condition will be avoided.

I have had this matter brought directly to my attention here in our fishing streams, and I printed cards with instructions upon it, and distributed them broadcast and it has been surprising to note the results, and how readily the fishermen adopt the information given and thereby carry out the meaning of the law.

The conditions that exist here in Colorado are no different than they are in other States where the law provides a size limit for fishing. I truly hope that the American Fisheries Society will take some action in the matter.

I enclose a "Resolution" that will bring the matter before you for discussion.

Yours very truly,

G. H. THOMSON.

Whereas, It having been brought to the attention of the members of the American Fisheries Society, that while many of our States have passed laws establishing a size limit for fish that may be held for table use, they have said nothing whatever about how to handle a fish in taking it off a hook in order to save its life; therefore be it

Resolved, That we, the "American Fisheries Society," do most heartily endorse the card that is being circulated by G. H. Thomson, Superintendent of the Fish Hatchery at Estes Park, Colorado, in his "Plea for the Fish" and that we would urge upon the fish commis-

sioners of all the States, where there is a size limit on fish, to have this information made a portion of the fishing laws of their states.

This is not approved as a resolution but it is recommended that the various state commissions educate the people by every means in their power to follow the directions given in this resolution about wetting the hands.

Mr. Clark: Is this gentleman a member of the association?

Mr. Willard: Yes.

President (Mr. Meehan): This card has been sent broadcast throughout Colorado and sent to some commissioners. I received one. It is probably a good thing, but it seemed to the committee to be not proper to recommend to put in as a definition of the law or something to be done by the law, and as apt to befoog the people.

Dr. Birge: I move that the recommendation of the committee be adopted.

Motion seconded and unanimously adopted.

President (Mr. Meehan): The committee recommend the adoption of the following resolution presented by Dr. Hugh M. Smith:

Resolved, By the American Fisheries Society in annual meeting assembled, that we have learned with pleasure of the conclusion of a treaty between the United States and Great Britain by which the fishery question affecting the operations of United States fishermen on the coast of the British North American provinces will be submitted to arbitration.

Resolved, That the conclusion of a convention between the United States and Great Britain, by which the regulations of the fisheries of the contiguous waters of the United States and Canada will be assumed by the two federal governments, marks a distinct epoch in the history of American fisheries; and we pledge our official and personal efforts to facilitate the work of the International Fishery Commission, appointed under this convention.

Motion made, seconded and unanimously carried adopting the resolution.

President Meehan: The committee on resolutions unanimously recommend the passage of the following:

Resolved, That the American Fisheries Society, in annual meeting at the seat of government of the United States, expresses its great satisfaction at the attitude of the President of the United States toward fish protection and preservation as recently exemplified in his formation of the National Conservation Commission.

Resolved, That we pledge our individual and collective support to the measures that may be found necessary for carrying out the President's views.

Resolved, That a copy of these resolutions be forwarded to the President.

Motion made, seconded and unanimously carried, adopting the report of the committee and its recommendation.

President Meehan: Dr. James A. Henshall of Montana has presented to the committee the following resolution:

Whereas, In the irrigating canals already constructed by the United States Government in the western states there is no provision made for the preservation and protection of fish, either by screening the canals and ditches, or by the erection of fishways in the dams connected therewith; and

Whereas, The Government contemplates a still more extensive system of reclamation of arid lands, by the building of storage reservoirs in the mountain gulches, and by the construction of irrigating canals of great length and capacity, that are to be supplied with water from flowing streams; therefore be it

Resolved, That a memorial be presented by this Society to the Congress, asking for such legislation as will provide for building practical fishways in all dams connected with the work of reclamation of arid lands; and also to provide for the installation of some effective device at the intake of all canals and ditches in connection with said work, in order to prevent fish from entering them.

President Meehan: The resolutions committee approved this resolution with the recommendation that Dr. Henshall, who drew it, draw the memorial and forward it to the chairman of the executive committee to have it properly endorsed and forwarded to the federal authorities.

Motion made and seconded that the recommendation and report of the resolutions committee be adopted.

Dr. Birge: It seems to me that resolution should be qualified. We are asked to memorialize congress that legislation should be enacted requiring fishways in all dams connected with the work of reclamation of arid lands. Many of those dams are

built on streams which are dry a good share of the year, and never had or will have any fish. I think the wording of the resolution might well be changed in that particular so as to indicate the style of dam in which we wish to have fishways.

President Meehan: How would it do to insert the words "suggested on the recommendation of the bureau?"

Dr. Birge: Yes, or on all dams across streams containing fish, or something of that sort.

President Meehan: Those words will be inserted "on all streams containing fish."

Mr. W. T. Thompson, of Leadville, Colo.: I just want to say that while that might apply in the beginning it won't carry the thing through, because in some of the best places that we have in the Rocky Mountains for taking fish spawn when the dam was built we found the stream above contained no fish. There is one reservoir that I think of in particular, where we have taken upwards of 4,900,000 eggs, and fifteen years before that date it was nothing but a mountain meadow. Now very few of these reclamation projects are contemplated in places where it would not be possible and feasible to have fish.

Dr. James A. Henshall, of Bozeman, Mont.: The resolution is only intended to apply where canals are taken out of flowing streams that already contain fish. It does not apply to reservoirs in mountain gulches. There is a dam soon to be built in Wyoming twenty-five feet higher than the Flatiron Building in New York, but that would not be covered by the resolution; it applies to flowing streams where canals, sometimes 200 or 300 miles in extent, are taken from a river, and that is where some device should be placed for keeping fish from entering the canals; and in dams that are not too high practical fishways should be installed. That is the meaning of the resolution. It does not affect those immense reservoirs built in mountain gulches where the water would be perhaps several hundred feet in depth, and where no fresh water fish could live.

Dr. Birge: I move the wording of that resolution be left to the committee on resolutions to revise if it deems it wise to do

so, before printing. I mean that the resolution be adopted in substance, and that the wording of it be referred back to the committee for revision if it deems necessary.

Motion seconded and unanimously carried.

President Meehan: The following resolution has been presented to the committee by Mr. Wilson:

Whereas, One of the chief objects of the American Fisheries Society is the treatment of all questions regarding fish, of a scientific and economic character, and

Whereas, The members of the American Fisheries Society now assembled in the city of Washington, D. C., in view of the rapidly decreasing supply of fresh water fishes in many states and provincial waters with its attendant hardships upon the poor, as shown by the great increase in the price of the same, as well as in the ever decreasing catch of the sportsman, also affecting the very life of a great industry, are of the opinion that the present general legislation regarding closed season and size limit does not furnish the maximum amount of protection, and

Whereas, Through inability to shorten open seasons, or to specially legislate for certain localities where spawning actually begins before and extends beyond the period designated as the closed season, certain sections are deprived of the protection necessary to keep up the natural supply of new life; therefore,

Resolved, That we urge the various states and provinces of North America to enact such legislation as shall under severe penalties prevent the capture or disturbance of fresh water fishes while on their spawning grounds for the purposes of reproduction, such legislation in no way preventing the taking of fish or spawn under the supervision of state, national or dominion authority. Further

Resolved, That copies of this resolution be furnished the fishery departments of the various states and provinces of the Dominion of Canada.

President Meehan: That is not approved. The committee feels the matter is one governed entirely by local conditions and should be considered by local legislatures.

Mr. Clark: I move the adoption of the committee's report. Motion seconded.

Mr. Wilson: As the father of this resolution I wish to state that this is my first appearance in the meetings of the American Fisheries Society. I wish also to state that it is not the first time that a resolution of mine has been rejected by the commit-

tee on resolutions. I am not a scientific man, although I hold a paper that might permit me to take up the work of a fish hatchery. I am interested in the protection of the food fish of North America, and have been identified with that work for ten or more years, having spent my time and my money in the effort to conserve the food fish of this continent. Why, may I ask, should this resolution fail of passage in an organization, grand in all its departments, one of whose chief aims is the protection of the fish of this country? This is not a strange thing I am asking of you, gentlemen. You set apart certain localities to make up for losses of fish in certain waters, do you not? Other countries do. The state of New York sets aside streams to conserve the fish therein and to assist in the preservation of new varieties of fish. For instance, the streams flowing into Lake George, nine miles from my home, were closed entirely when they were stocked with landlocked salmon. Every argument that has been made today has been in favor of my resolution. The president of this organization said that there had been a bill presented in congress asking for some ninety-seven hatcheries to be built in the United States. Is that an argument, gentlemen, that your fish hatcheries are doing all the work and doing it successfully? I think not. It is said that this is a local affair. Well, perhaps it is. It is local, I will admit, in the state of New York, where the St. Lawrence river is open to bass fishermen the 19th of June, although the bass does not complete its spawning until early in July, on that river. Now what are you doing with that fish? How many bass have you hatched this last year? We had one application from the Anglers' Association of the St. Lawrence river for over a million bass. They said it was a joke when we called their attention to the fact that they opened the season for bass too early on the St. Lawrence river. Is fishing on the St. Lawrence river a local question? I hardly think it is. Now I have been identified with an organization called the North American Fish and Game Protective Association, whose chief end is to harmonize the law between the United States and the Dominion of Canada. As an officer in that organization I have been in close touch with the bureau of fisheries in the provinces of the Dominion of Canada. I know something about their fisheries. I heard some of the best men in Canada, pro-

fessors in the McGill University, in convention in Montreal, ask that the clubs of the provinces of Quebec and New Brunswick be thrown open to the public. They were asked why they did not fish for salmon in the other rivers up there. They said there were no salmon there, they had all been taken out! Is my resolution in line with the protection sentiment? Now we have a lot of Americans who go into Canada in clubs. I am a club member myself. Before the close season commences in Canada there are hundreds of pounds of brook trout taken off the spawning beds in the lakes and streams of Canada. Perhaps the American Fisheries Society does not have anything to do with the Dominion of Canada; but let me tell you gentlemen, you cannot divorce the question of the food supply as between the Dominion of Canada and the United States. New York state alone eats more Canadian fish than Canadian people do. Why? Because they need the fish and Canada needs the money. It is not a harmful thing, I am sure, to ask protection where the law is not put on soon enough, and where it is not kept on long enough, so that it protects at neither end in certain localities.

I have been forced to realize here this afternoon that in Pennsylvania and in other states bordering on the great lakes everything is all right. As a citizen of New York state I want to say that we are in trouble, are willing to own it and ask you for help. Will you give it to us?

Mr. George M. Brown, of Detroit, Mich.: With us the close season begins the 1st of May and ends the 20th of June. That is the whole state where the bass are not off their spawning beds when the close season ends. I am in favor of the resolution for the protection of the fish. The reason we have not changed the law in Michigan is because the local fishermen have had more influence in the legislature than all the friends of game protection.

Mr. Atkins: There is an abundance of law already in that direction. This resolution proceeds on the ground that we need legislation to protect the fish. But there is an abundance of law in almost every state. Probably there are some points that could be amended, but I take it that in almost any state in the union it would be quite easy to get those amendments made if the matter were properly presented to the legislature. So it seems to

me that this resolution is entirely out of place, that there is no call for it whatever.

Mr. Clark: In moving the adoption of the committee's report, I had in mind the trend of what we have done here today in a way of requesting legislation in regard to federal power. I thought probably the committee had that more in mind when they failed to approve of this resolution than anything else, and that so far as inland matters of the different states and provinces were concerned, the committee thought that the states themselves would take care of and handle their local legislation. I was not on the committee on resolutions, but that is what I thought the committee on resolutions had in mind, and it is what came into my mind at once, and therefore I moved the adoption of the committee's report. Now anything that will tend to help local legislation in inland waters I think the American Fisheries Society should endorse. We may not all be of the same mind as to how it should be done. Of course, it is well known that I do not approve of many of the laws that are on the statute books of the different states of the United States and provinces of Canada today, and no doubt you will realize that when you hear a paper I have prepared for the International Congress.

Now, so far as the bass are concerned, the close season laws of the different states should be strict, as the bass are rigid bed guarders. The time that matter was before the legislature of the state of Michigan I was asked by the chairman of the joint committee of the two houses to appear before them and give my views, and I think very likely Mr. Bower and some of the other commission men were; and I did, and I told them I would not have a close season but I would have an open season, and that open season would be only such time as would give the rod and line a chance to catch the fish, and in Michigan I would have the season open from the 1st of July to the 1st of November, and all the balance of the time closed. That is what I believe in so far as the bass is concerned, and no doubt your New York state law should be on that same principle. In other words, make the time as low as possible. I believe in that, but I do not believe that this society should take the matter up in such a broad way, as the resolution of Mr. Wilson would. Mr. Clark I think has

sounded the very key note of the matter. I realize that the bass season in Minnesota opens too early—the 29th of May. If this resolution dealt entirely with international or interstate waters even, the committee would have supported it, but I think it would be foolish to adopt it in the way it now reads.

Mr. Wilson: May I say one more word? I have no intention of trying to stampede you gentlemen to do something that you think is not right, but I want to say to you right here that the American Fisheries Society is an organization of high standing in this country. It has been my privilege to be invited to every fisheries conference that has been held in the province of Quebec in the last ten years; and I state that the proceedings of the American Fisheries Society have been freely used in those conferences. They believe that the American Fisheries Society is composed of a large body of high grade men in every department. Now, that being the case, are you not making a mistake if you do not set these people right when you have the opportunity?

As a representative of the protection element in the state of New York, I say that Mr. Whipple, the present commissioner, and the most capable one the state ever had, has given us practically all the legislation we ever asked for, with the possible exception where he was satisfied that we could not get it, and one of those instances is this question of taking bass out of the St. Lawrence river before they have spawned. Why, in public hearings before the legislature, a former superintendent of public instruction in the state of New York, and president of the Anglers' Association of the St. Lawrence, fought the shortening of the bass season, and all the members of the Anglers' Association, as well as the railroad interests, fought it. They wanted to get on the St. Lawrence as soon as the ice was out and the bass had stuck his nose out of the mud—if he stays in the mud. So that thing went on year after year, when Canada was setting us an example of having a season six or seven days later. Now we have succeeded in shortening the season this year seven days, and placing it in harmony with the Canadian law. That is why our association was born—to harmonize law, and to fight for international control. Gentlemen, referring to the influence of the American Fisheries Society, I reiterate that you possess more in-

fluence than we. It took two years for us to get a public sentiment on international control, and my first resolution went where this resolution went, and I said, gentlemen, we will come back and when we come back we will take you all in, and we did. I wish I could take you all in here tonight, and have you give moral support to this resolution which does not apply to any state in the union in particular, which does not ruffle a hair on any man's head, unless he is anxious to have it ruffled, and this is strictly in line with the protective system which we are all anxious to advance and for which the society stands; and I trust that the resolution will be passed unanimously.

Dr. Birge: It seems to me that this discussion is on a matter where all of us are agreed in principle, and where we differ as to the means of securing the end. There is no one here who does not believe in protecting fish, and this association is doing all it can to secure good legislation on the part of states and provinces, as far as we have influence with them. There is no difference of opinion among us here on the question of principle; the difference of opinion that has arisen here, is with regard to the specific things that are recommended in this resolution. While I am in full sympathy with the aims of the recommendation, there are several things in it for which I should not vote. I believe with Mr. Clark that the best method of protecting bass is not through special legislation, assigning a certain close season here and another there, but legislation along the line of a limited open season; and I am not ready to recommend the adoption of the opposite principle, because I do not believe it will work. Take a state like Wisconsin, extending over a long distance from north to south, with a great difference in the spawning season between the lakes in the northern and southern part of the state. If our legislature should legislate along the lines of this resolution it would make a certain open season for Vilas county, and another for Dane county. Now I do not believe that legislation of that special kind, lengthening the season and shortening it in another place, is going to stand. As a matter of fact, when that legislation is attempted with us in Wisconsin and attempted in good faith on all sides, each legislature sees the fish laws changed and modified as this man and that man wants, until no one in the state of Wisconsin (unless he is a Philadelphia lawyer)

knows what the laws as to fish and game are in the state. I ask you if that sort of tinkering of laws has not produced very much the same effect in other states.

Again, I think that this matter of imposing severe penalties is a mistake. I do not believe that by increasing the penalties provided in the laws of various states, the protection of fish is going to be advanced; I think it is going to be injured: I think you will find that where severe penalties are laid down by such laws, the result is that the law is not enforced, and that the severity of the penalty tends to make the law ineffective, because officers of the law feel that the penalty is not warranted by the crime, and shut their eyes to the offense. What we want is organization for the enforcement of moderate penalties so that they will be enforced with reasonable efficiency and with reasonable certainty.

While, therefore, I agree entirely and heartily with the spirit of this resolution I do not agree with its recommendation. I concur with the committee in that matter and I therefore move, since we are all agreed on the question of principle, that the resolution be referred back to the committee, to draw such a statement of the opinion of this society with regard to this resolution as seems wise and present it later.

Mr. Seymour Bower: As one of the members on the committee on resolutions and as one who opposed the adoption of the resolution under consideration, I want to say that the main reason why I did so is that this resolution is so broad and general that you can enact almost anything under it and claim that it has the backing of the American Fisheries Society.

Now if this gentleman (Mr. Wilson) has any specific proposition and will bring evidence to us that the sort of protection he recommends is needed in his locality, I will vote for it heartily, and I think every member on the committee will; but we do not want to be saddled with this resolution. This expression, "Protection of Fish," is a very deceptive phrase anyway. What one man thinks is protection another man does not. We disagree and we do not want to be called upon to father a general resolution that does not mean anything much in one way and may mean almost anything in another.

Now, as I say, if this gentleman will bring in a specific

proposition looking toward the protection of fish we will support it.

Mr. Wilson: I offered to amend my resolution before the committee this noon, and asked them for suggestions on which I could base an amendment.

Mr. Seymour Bower: The resolution as introduced makes no provision whatever for allowing fish to be caught for the purpose of propagation, but absolutely prohibits the propagation of fish in commercial waters, and we suggested that that exception be made, and I notice that it is taken care of.

Mr. Meehan: The preamble was of such a character that the committee could not support it. The broad assertion was made in the original resolution that there is a rapidly decreasing supply of fresh water fishes; that was not a matter that the committee could subscribe to, and it so stated and the framer of the resolution subsequently brought in an amendment which was inserted, restricting the statement to "many of the states." At first there was a sweeping general statement that the fish were decreasing in all the streams of the country, and the other members of the committee have stated the matter just as I understand was the thought of the committee, and we felt that if we could not present the resolution with our approval in the form in which it was, we could not doctor it. The question was, could it be changed to meet with the general approval of the committee without framing something entirely different. If there was something specific, as Dr. Birge put it, presented, I have no doubt the committee would be glad to do something with it.

Mr. S. F. Fullerton, St. Paul, Minn.: As a member of that committee I should heartily endorse a resolution along the lines suggested. I know the gentleman's heart is all right, and that he wants to be right.

Mr. M. G. Sellers, Philadelphia, Pa.: Speaking for the state of Pennsylvania, I want to say that through the legislative committee of the Pennsylvania Fish Protective Association I was largely instrumental in securing the passage of a law making the open season for taking bass begin on the 15th of June, instead of the 30th of May. This was accomplished only after a great

many years of labor, and was due to a spirit similar to that which is expressed in the resolution under consideration. But as a born angler I am afraid my friend who spoke before me (Mr. Wilson) fails to place a proper share of blame on the sporting ranks for lack of results in an assertion so sweeping in character as to declare waters depleted of fish life.

When it comes to the bass question, unaided by artificial propagation, what is a sportsman's share, who does or should determine it? I believe from my own experience in the state of Pennsylvania where for very many years I have been active in securing proper legislation regarding fish, that we ought to leave questions of this kind to the different states. As I see it from the fish protectionist's view point, if they suffer from poor laws in New York state or in any other state, why is it not up to the anglers of the particular state to correct the laws? Why not organize a good central organization in all states to combine all the local or county organizations, and back up what is really the ideal of the sportsman, both for the close season and the numbers to be taken?

As a sportsman I want to say to you I cannot find any national standard to determine what is a sportsman's share. Nobody seems to know and nobody seems to set it. I wish I may see the day when the preliminary labors that we undertook in New York City last November will bring about an Anglers' Association of the United States. There is the place where I think a very important part of this question should have its greatest force and argument in co-operation with the work of this society.

Nowadays everybody goes fishing. You know as well as I do how the angling ranks of the great United States by states as a whole are heavily recruited each year. They pose as sportsmen, but do you really believe they all are? I cannot see it, so long as the idea of quantity is so generally accepted as the standard of skill. What we ought to labor for is to create higher ideals of sportsmanship in taking out of the waters what largely interests this society in placing therein, not to mention greater purity of the waters, but I hope this can be accomplished in the proposed new organization for which the preliminary meeting was held in New York City; and I trust that the time may come

when we can thus improve the sporting ranks to the end that we will get along more smoothly in connection with the fish cultural work of this society, and thereby relieve the various fish commissions of much unjust criticism of their work, and possibly increase their appropriations for scientific field work to more correctly determine as matters of fact whether or not waters are fished out.

Mr. Titcomb: I cannot help getting up to second the suggestion. I concur with Dr. Birge in his remarks, and I am in favor of the principle of Mr. Wilson's resolution, and if the committee could get that resolution into shape I would like to see it done. I am also a charter member of the North American Fish and Game Protection Association, and I know any resolution that this organization passes will have some influence there, where Mr. Alvord suggests that we have these local organizations to protect the fish where they ought to be protected, without inspiring a lot of cranks to introduce new legislation, and we all know that every legislator has to face fifteen, twenty or thirty times as many bills as ought to come up. If we can only get something that would do good and not do harm I would like to endorse it and help it through.

President: You have the motion of Dr. Birge that the resolution be referred back to the resolutions committee in order that it, in connection with the author of the original resolution, draft something in accordance with the views of the society that can be properly supported.

Motion unanimously carried.

Mr. Titcomb: When I moved that the matter of the time of holding the next meeting be laid on the table I did not think it would be well to hold a meeting at that time every year, and I think so still; but in view of all the arguments in connection with the location, and the fact that we are operating hatcheries at that time and fish will be seen on the spawning beds, and fish cultural operations inspected, I now move the adoption of the resolution.

President: I think it would be proper first to move to take the resolution from the table.

Motion made, seconded and unanimously carried, taking the resolution from the table.

Mr. Titcomb: I now move its adoption, that is, that the report of the committee on time and place be adopted.

Moved and seconded and unanimously carried, and report of committee unanimously adopted.

Mr. Clark: Are you ready to hear the report of the committee on size of fish?

President: Yes.

Mr. Clark: I can state that I weakened when we had our committee meeting on the size of fish and concluded that perhaps it would be better after hearing the discussion of the committee and members invited, and after talking the matter over very thoroughly, to make some change, and I will read the conclusion of the committee.

The committee report that the regulations regarding size of the fish remain the same, excepting that there be a subdivision of the numbered fingerling class to be designated by the letter A, to-wit:

Fingerlings number 1, one inch and less than one and one-half inch.

Fingerlings number 1 A, one and one-half inch and less than two inches.

Number 2, two inches to two and a half inches.

Number 2 A, two and a half inches to three inches, etc.

This was signed by the entire committee and I move its adoption.

Motion seconded, unanimously carried and so ordered.

Mr. S. F. Fullerton, of St. Paul, Minn., then read a paper on the subject of "The Modern Hatching House," which was discussed.

Mr. Jerry R. Berkhaus, superintendent of the Pennsylvania State Hatchery, Torresdale, Philadelphia, then read a paper on the subject of "Some Experiments in the Artificial Expression and Fertilization of Gold Fish."

President: The question now arises whether we shall go on

reading further papers. Possibly we might have a paper early in the morning.

Mr. Clark: I suggest that we adjourn, subject to the call of the president. We must get away from here at 9:30 o'clock, and I should think it would be better to adjourn subject to call, and if we find it impossible to get a large attendance, a few at least could meet and decide what to do with the papers.

President: They will be printed. We will get them in the proceedings. I think some definite action can be taken in regard to the disposition of the papers still unread. It is all very well to assume that they will be published in the annual report, but unless the authority is given they might not be published, and they all seem to be papers of value.

Mr. B. D. Evans, of Harrisburg, Pa.: A resolution was passed this afternoon that we should adjourn subject to call.

Mr. Clark: I suggest that we call for any unread papers on the program.

(The president then called the list of writers of papers on the program, still unread, but received no response.)

Mr. Titecomb: In view of the fact that the authors are not present I move that we consider that these papers have been read by title only, and that they be published in the transactions of the society if the committee consider them worthy.

Motion seconded.

President: It has been moved and seconded that the papers referred to be considered as read by title, and published in the annual report, provided the committee so decide.

This motion is seconded.

Mr. Fullerton: I hope that motion will not be passed, because we certainly will have time to hear some of these papers, and I know every member here wants to hear them—especially on the muskalonge question, and on the black bass.

President: And the lobster—if we could hear these papers and have a discussion of them it would be of benefit to every person here.

Mr. Clark: I move an amendment to the motion, that the matter be left open, and if time is not given us to have the papers read that they be published as stated.

Mr. Titcomb: I will withdraw my motion.

Mr. Clark's motion was then seconded and unanimously carried.

Meeting adjourned subject to the call of the president, pursuant to the resolution of this afternoon.

Same place, Wednesday, September 23, 1908, 7:30 p. m.

Meeting called to order by Mr. Meehan in chair.

President Meehan: Is there any unfinished business besides the report of the committee on resolutions?

The following resolution was presented by the committee on resolutions:

Whereas, One of the chief objects of the American Fisheries Society is the treatment of all questions regarding fish, of a scientific and economic character, and

Whereas, The members of the American Fisheries Society now assembled in the city of Washington, D. C., in view of the efforts being put forth by state, national and dominion departments of fisheries, in the artificial propagation and planting of various kinds of fresh water fishes, and maintaining the same for the public good, are of the opinion that the various states and provinces should supplement this great work by giving additional protection to all nest building fishes during the breeding season; therefore,

Resolved, That we urge the various states and provinces of North America to enact such legislation as shall prevent the capture or disturbance of nest breeding fishes, while spawning, and guarding the nests and fry. Further

Resolved, That copies of this resolution be furnished the Fisheries Departments of the various states of the American Union and provinces of the Dominion of Canada.

This has the approval of the entire committee.

Mr. Fullerton: I move that the report be adopted.

Motion seconded and unanimously carried.

President Meehan: If there is no other business it will be

my pleasant duty to appoint a committee of three to escort the newly elected president, Dr. Tarleton H. Bean, to the chair. There being no objection, I will appoint Mr. Frank N. Clark, Dr. J. A. Henshall and Mr. S. F. Fullerton as a committee to escort the newly elected president to the chair.

(The committee then escorted Dr. Bean to the rostrum amid great applause.)

(Dr. Bean took the chair.)

Dr. Bean (In chair.): Fellow members of the American Fisheries Society, I have very little to say to you except to convey my high appreciation of the honor which you have done me in electing me president of the society, and I promise that I will do whatever lies in my power to advance the interest of our cause. I hope that our future will be brighter and brighter from year to year, that our progress will be more rapid from now on than it has ever been before, and in order to accomplish this end I will work with you, and I am quite sure that I will have your most hearty co-operation. I thank you. (Great applause.)

President (Mr. Meehan, in chair.): The same committee will escort the newly elected vice president to the platform.

(This was done.)

Mr. Clark: We take pleasure in introducing the new vice president, Mr. Seymour Bower. (Great applause.)

Mr. Seymour Bower: I did not expect anything of this sort or I might have framed up something to say. I can only say that I thank each and every one of you heartily and sincerely for the high honor that you have conferred upon me, and that I will endeavor to do everything in my power to assist the president in making the next meeting a grand success; and I do not want to make any more promises; I prefer to wait until next year and let you judge whether I have delivered the goods or not. I thank you very heartily. (Great applause.)

President Bean: What business have we before us?

Mr. Clark: It seems to me that the members must understand where we meet next year and the time, Yellowstone Park, the 12th of July, and that our officers and executive committee

must make the proper arrangements. They are not going, as I understand, into a town, but they are going into the Yellowstone Park. Just where we will have our meetings must be arranged for, and to me it seems as though this should be done early, and some circular, or something of that kind, should be sent out early to the members so that they may make their plans accordingly. As the Yukon Exposition is held next year, they may wish to arrange in connection with that, to take in the American meeting going or coming, and therefore, it seems to me it would be a good plan for the officers and committee to make their arrangements early as to where they will meet in the Yellowstone Park, and then send a circular early in the season, February or March, that the members may have plenty of time to make their arrangements.

Mr. Fullerton: There are two routes in the Yellowstone Park, and I do not doubt but that every member that goes there will want to go through the Yellowstone Park, as well as to attend the meeting there. I suppose Dr. Henshall will tell us something about that. But there is the regular stage route and there is the Wylie route, and I think the committee ought to take that into consideration and find out what the difference in cost is between the two routes, and if the Mammoth Hotel cannot take care of us we must meet somewhere else.

Dr. Henshall: As a member of the committee on time and place of meeting, I will say that the resolution states that the meeting shall be held at the Mammoth Hot Springs Hotel. That is the only suitable place, and it is only five miles from Gardner, the end of the railroad. The Wylie Company is now under the auspices of the Transportation Company.

Mr. Fullerton: They are all combined.

Dr. Henshall: Yes. They still have the permanent camps, the same as Wylie had them, and the Transportation Company has the hotels, so the only place where we could hold the meeting would be the Mammoth Hot Springs Hotel, and there is no doubt but that arrangements can be made to meet there.

Mr. Fullerton: I might say further that the National Game Wardens' Association went through the park, and I think Dr.

Henshall went through with us, and conveyances were placed at our disposal free of charge and all it cost was the hotel accommodations, and I think that that same arrangement could be made with the superintendent of the park. I think with our president's influence that it could be done, and I am satisfied if the right and proper people are appealed to that we can get the transportation through the park free of charge.

Dr. Henshall: Major Pitcher is not the superintendent now, but General Young is there, and I have no doubt that arrangements can be made for government transportation through the park.

Mr. Root: I think it would be well to have Dr. Henshall help the executive committee out in this matter.

Dr. Henshall: I would be perfectly willing to assist the executive committee.

Mr. Meehan: I had intended to place the matter in the hands of Dr. Henshall with the consent of the rest of the executive committee.

Mr. Titcomb: I suggest you add to that committee Mr. Booth, who will be in the park at that time, and will be doing work for the Bureau of Fisheries there. There are two or three methods of getting through the park, of course, any part of the body can go one way and another part another; part can have hotel accommodations and part can camp if they wish; and I think Mr. Booth would be a very good assistant to the doctor, because he is right there on the ground.

Dr. Henshall: That is a very good suggestion.

President: I understood that the arrangements for the meeting next year are in the hands of the executive committee, and that the executive committee has delegated its authority to Dr. Henshall, and there is a suggestion that Mr. Booth also act with Dr. Henshall. I think a motion to this effect would be in order, and I would be glad to entertain such motion.

Mr. Meehan: Perhaps this motion had better come from the chairman of the executive committee. I move you that the ar-

rangements for the meeting at Yellowstone Park be placed in the hands of Dr. Henshall with the assistance of Mr. Booth, of Spearfish, North Dakota.

Secretary Peabody: As I understand from Dr. Henshall and others, there is one hotel there only, and practically we can only deal with one corporation. Now it might be possible that if we decided definitely on going there, absolutely and arbitrarily, that we could not make quite as favorable terms as we could if it was left in some such form as this: That the executive committee might make this arrangement if satisfactory, to go to the Yellowstone Park; if not they could decide upon some other point. We might be held up I don't know as there is any possibility of that sort of thing; I don't know anything about the park; but it is in the nature of things, that if we definitely decide on going to one hotel, we will not get the best terms.

Dr. Henshall: I will explain that there are four or five hotels, but all under the same management; the Mammoth Hot Springs is the first hotel you come to after entering the park, and is the usual place of meeting of all conventions that go to the park; after you have concluded your deliberations you can make your tour around the park. The rates are the same at all hotels, but the Mammoth Hot Springs is the most suitable place for holding the meeting, because it is only five miles from the end of the railroad.

Secretary: I understand that, but it is only one corporation—the whole thing.

Dr. Henshall: Yes.

Secretary Peabody: It is all the same thing—they charge any price they please; is there any fixed price, or have you any terms from them?

Dr. Henshall: The usual price has been \$4 a day, and they made a reduction at the time that Mr. Fullerton speaks of, to the members of the Northwestern State Game Wardens and Commissioners' Association, to \$3 a day, and they will probably do the same thing in this case.

Mr. Titcomb: I think Mr. Peabody has the right idea. I

think the executive committee should have control of arrangements, and that Dr. Henshall and Mr. Booth should make their report to the committee, and then have the committee send out circulars in the regular way. It is not necessary that we hold our meeting at the Mammoth Hot Springs Hotel more than one day anyway. We can go into the woods, and we can camp out if we wish. They will camp your whole party right on a brook and you can have your meeting outdoors and go out in the evening and catch some fish for supper. (Applause.)

Mr. Meehan: I will accept that as an amendment.
Seconded.

President: The motion is that the executive committee take charge of the arrangements, through Dr. Henshall and Mr. Booth, who are to report to the committee.

Dr. Henshall: My suggestion was that I would assist the executive committee. The executive committee has full charge, of course, but I will assist them in any way possible, and so will Mr. Booth.

President: Then the motion stands that the executive committee take charge of the arrangements for next year, and that they will be assisted by Dr. Henshall and Mr. Booth.

Mr. Fullerton: You have added to that committee Mr. Booth, a splendid selection, and I would like to add another, and that is Mr. Scott of Montana, a delegate to this convention. He did not get here though. He is president of the National Game Wardens' Association and takes a great deal of interest in this work, and stands well with the park authorities, as Dr. Henshall knows. I refer to Mr. W. F. Scott—he is right there on the ground.

Mr. Meehan: That is acceptable.

Seconded and motion as thus amended unanimously carried.

Mr. Wilson: I rise to move the reconsideration of the resolution presented by the committee on resolutions regarding protection of fish during the spawning season.

Mr. Meehan: I rise to a point of order. Did the gentleman vote for the adoption of the resolution?

Mr. Wilson: If I had not done so I would not ask for a re-consideration.

Is there a gentleman here who will second my motion so that this matter can be brought up?

Motion seconded.

President: I understood when we came together we were to adjourn at 7:30 o'clock. What do you wish to do?

Mr. Wilson: Am I in order?

Mr. Meehan: The motion to reconsider is not debatable.

Mr. Wilson: I rise to a question of personal privilege.

President: What is the question?

Mr. Wilson: The question is this: That I did not understand the reading of this resolution by the chairman of the committee on resolutions. The spirit of this resolution, Mr. President, has been removed entirely from the resolution. Am I free to discuss the resolution?

President: The chair is in doubt as to the proper proceeding in a matter of this kind.

Mr. Titcomb: I move that the gentleman be allowed to explain his trouble. There must be some misunderstanding about the matter.

President: Very well.

Mr. Wilson: Mr. President and gentlemen of the American Fisheries Society: I hold in my hand three resolutions—one, the original resolution presented by me on the subject of "Protection of Fish During the Spawning Season," and turned over to the committee on resolutions. That resolution was rejected, and afterward a motion was made that the resolution be changed in some respects, and then presented to the resolutions committee. In that committee it was suggested that the drafter of the resolution eliminate the so-called objectionable features of the same, and the chairman of the committee appointed Dr. Birge to confer with me regarding it, with the implied, if not expressed, understanding that what Dr. Birge and myself agreed regarding

the resolution would be satisfactory to the resolutions committee. Mr. President, with your permission, I wish to read the result of Dr. Birge's and my efforts in the production of a resolution that should suit the resolutions committee, which is as follows:

Whereas, One of the chief objects of the American Fisheries Society is the treatment of all questions regarding fish of a scientific and economic character, and

Whereas, The members of the American Fisheries Society now assembled in the city of Washington, D. C., in view of the efforts being put forth by state, national and dominion departments of fisheries in the artificial propagation and planting of various kinds of fresh water fishes, and maintaining the same for the public good, are of the opinion that the various states and provinces should supplement this great work by giving additional protection to all such fish during the spawning season. Therefore

Resolved, That we urge the various states and provinces of North American to enact such legislation as shall prevent the capture or disturbance of fresh water fish while on the spawning beds for the purposes of reproduction, such legislation in no way preventing the taking of fish or spawn under the supervision of state, national or dominion authority. Further

Resolved, That copies of this resolution be furnished the Fisheries Departments of the various states of the American Union and provinces of the Dominion of Canada.

Mr. President, I understand that the serious objection to my resolution is because it does not allow a given state having forty-five miles of shore line on a lake 414 miles long, the right to take fish from the spawning grounds during the proposed close season.

I stand here, gentlemen, in favor of protection of every valuable fresh water fish that swims, from the time it reaches the spawning bed for the purposes of reproduction until it has performed its function and retired decently and in order.

Furthermore, gentlemen, the best years of my life have been spent in seeking to formulate fishery regulations between the Dominion of Canada and the United States, so that there should be a maximum amount of protection to the food fish for the common people of both countries. I stand on that platform tonight, and if I go down to the disgrace of the American Fisheries Society.

A year or two ago the secretary of the New York Fish and Game Commission, with which your honored president is identified, asked me to take up the subject of the protection of the

whitefish, that they might not be entirely wiped out of the great lakes that border upon the state of New York. I am a busy man, and burned the candle at both ends to familiarize myself as a civilian of the state of New York, with this matter, that I might go before the authorities of the Dominion of Canada, the Province of Ontario, and my own state, which I did, and secured at the last session of the legislature a bill in harmony with the laws of every other state bordering on the great lakes, in which New York is interested, save the little forty-five mile territory of the state of Pennsylvania.

Now it is the proud boast of the Pennsylvania commission that they take more commercial fish this year than they did last. I am glad of it. I yield to no man on this floor the credit I would give to Mr. Meehan or any other commissioner of fisheries, or any hatchery man. They have my admiration. They have my muscle; they have what little brain I have got, and a good deal of talk.

Now let us see. There is not a state that borders on Lake Erie; there is not a province that borders on the great lakes, that has not a certain element of harmony of law regarding the protection of the food fish of those lakes—save the state of Pennsylvania.

We do not have to go far to find the reason why the representatives of the state of Pennsylvania wish, at this time to kill this resolution. In 1907 out of the four hundred and sixty million eggs allotted to seventeen states, Pennsylvania received two hundred and sixty-two millions; out of eighty-seven million Whitefish eggs allotted, she received fifty-seven million; out of two hundred and fifty-seven million Pike Perch eggs allotted, she received one hundred and ninety-four million; out of twenty-three million Lake Trout eggs allotted, she received two and one-half million; of Lake Herring, she received all taken by the United States over eight million.

In addition to this the New York Department of Fisheries rendered valuable assistance; while the Canadians at the north practically filled two of the Pennsylvania hatcheries with eggs given by the Department of Fisheries.

From this showing collected from the records it is very evident that Pennsylvania seeks to take an unfair advantage in the

great lakes over the other states and provinces bordering upon the same.

Mr. Fullerton: I rise to a question of personal privilege. We are all anxious to get to the other meeting, and let the gentleman speak to the resolution.

Mr. Wilson: I will admit the resolution without further argument.

Mr. Titcomb: By means of this resolution which you want to get through, do you want to take whitefish and also give them a close season?

Mr. Wilson: I want the resolution just as it was accepted by the referee.

Mr. Titcomb: Does that contemplate the protection of the whitefish during the spawning season?

Mr. Wilson: Yes, sir.

Mr. Titcomb: You ought to hear the three papers which are competing for a prize on this very question, as to how to improve the production of whitefish. Every one of those papers makes different arguments, but each one of them advocates fishing for the whitefish during the spawning season when they are in their best condition, and stopping the fishing for them during the period other than the spawning season, but that the eggs of all these whitefish caught during the spawning season be put into the hatcheries. Now the resolution, as you want to pass it, is in direct opposition to the argument of these three authorities. That, I suppose, is the reason that these gentlemen here who are on that committee, have opposed it.

Dr. Birge: Since I have been drawn into this matter by the statements of the gentleman who just had the floor, I wish to say that I did not understand that I was a referee in the sense that the committee was bound to accept what was put before it. Mr. Meehan asked me, since I had proposed this method, if I would not talk the matter over and see if a resolution could not be framed which might be accepted. As this resolution was presented I understood that by the use of the term "fresh water," shad and salmon were excluded from its terms.

Mr. Wilson: Certainly.

Dr. Birge: I understood also, though I did not express this to the gentleman, that I did not suppose that the regulation of fisheries in the great lakes was contemplated in the resolution, since the matter of the regulation of these fisheries is now in the hands of an International Commission, and the regulations are now being drawn up by a commission with which we have nothing to do. I called the attention of the gentleman to the fact that the whitefish of the inland lakes cannot be caught at any other time than the breeding season, but that if this resolution were adopted the association would be bound to maintain that form of protection, and so to exclude these fish permanently from any use whatever in an economic way. I said that I did not believe in that, although my own state has such a law, and the gentleman said he supposed in cases of that sort exceptions would be made, no doubt wisely, by the legislatures of the various states. I knew, however, that there was this exception and called his attention to it, but I saw nothing in the resolution as drawn up, which should have prevented him from offering it to the committee. There was nothing in my relation to it to hinder the committee on resolutions from using the same freedom with that as with any other resolution before them.

President: I want to call attention to one thing, and it is this: Mr. Wilson was speaking to a question of personal privilege. The only matter that could call for debate at present is his resolution to reconsider the vote. Are you ready to discuss that resolution?

Mr. A. Kelly Evans, Toronto, Canada: As the only representative here from the Dominion of Canada, possibly I might be spared a few minutes in consideration of the fact that the Dominion of Canada owns the other half of the great lakes. I have just heard the gentleman who sat down make the statement, if I understand him correctly, that whitefish are caught at no other time but in their spawning season.

Dr. Birge: In the inland lakes.

Mr. Evans: I have lately been partaking of a great many whitefish in my own country, caught at this season of the year.

Dr. Birge: Well, that is not true with us.

Mr. Evans: Well, with us, sir, we have an ample supply of whitefish caught at other seasons besides the spawning season. Further, the policy of the dominion coast has been to respect the whitefish during their spawning season. To me the resolution appears to be one of very great importance. Mr. Meehan is in the happy position of doing more in his state of Pennsylvania for hatcheries, as I understand it, than any state in the union, and is almost reaching that point where he comes within a measurable distance of the total output, as I am informed, of spawn in the whole of the federal government. We, in the Dominion of Canada, are not in such a happy position. We are dependent largely upon the natural habits of the fish to propagate their species. If this society turns down my friend, Mr. Wilson's resolution, it practically places this body in the position of giving an opinion that we must depend entirely upon hatcheries and absolutely not consider the natural functions of the fish as being at all effective in reproducing their species. We in the Province of Ontario feel that in one lake in which New York has a great interest, namely, Lake Ontario, there is only a small portion of that water on our side of the border suitable for the propagation of the natural spawn of the fish, and if you do not consider the resolution of Mr. Wilson it places this body at any rate, as giving an opinion which will help our friends the enemy, the net fishermen of my own province, in carrying on the destruction which has brought the fisheries on our side to their present condition. I will admit that if you have the happy condition that Mr. Meehan has in the state of Pennsylvania, whereby he is able to turn out an immense number of spawn into the water, the resolution possibly is not necessary, but we have not on our half of the border line that happy condition of things, and must at present, depend largely upon the fish carrying on their own natural propagation.

Therefore, I appeal to this body to go very slowly in this question, either for or against it. As has already been intimated, the matter is now in the hands of a royal commission, and I may say to you, Mr. President, that I feel satisfied that the action of this important body last year at Erie, Penn., in passing the resolution which I had the honor to introduce, had something to do

at any rate on our side, sir, in making that treaty possible, and I think the American Fisheries Society has reached that point where any resolution it passes, or any policy that it recommends, will receive the serious consideration, not only of your own federal government at Washington, but of our federal government at Ottawa; and I think that possibly if some arrangement could be made whereby the resolution was neither, as it were, knocked one way or the other, a great good could be done, and I do think, Mr. President, that if you take any action it places you on record, as it were, in upholding the theory that we can get along with hatcheries alone and catch the fish on the spawning ground, if you allow that theory to get abroad, with your endorsement, it will undoubtedly do a great harm to the fisheries of the great lakes.

One more word: I ask any of you gentlemen, who take an interest in this question, to read the report of the Royal Commission, appointed by the Dominion government in 1892, and you will find in the sworn testimony of net fishermen, many of whom are alive today, that the practical destruction of the whitefish of the great lakes was undoubtedly due to fishing during the spawning season. Gentlemen, when you attempt to make science exclusively accomplish what nature has done up to the present, you take an immense responsibility upon your shoulders. I am not a scientist; I do not profess to be one. I have joined this important body for the purpose of receiving an education in the scientific end of the matter, but I say in closing, this: Do be careful in any steps that you take not to give our friends any further advantage of which they will be quick to avail themselves for their own selfish and temporary benefit, to destroy food supply of the masses of the people. (Applause.)

Mr. Charles E. Fryer, England, Inspector of Fisheries: Mr. President and members of the American Fisheries Society, I crave your indulgence as a young member. I am afraid I do not look it and I am afraid I do not altogether feel it, but I am a young member of this society—young in membership at any rate, but possibly with some considerable amount of experience in regard to the various policies that are adopted and suggested with respect to the preservation of fish and fisheries. I had the honor of being elected an honorary member of your society a

couple of years ago, on the nomination of Dr. Hugh M. Smith on, as I understand, the ground that I had had considerable experience in fishery questions outside of America, mainly in England; but not merely as an Englishman but as interested also in the fisheries of the Dominion of Canada and not less interested, being a fisherman, in fish and fisheries wherever they may be found. I desire to express a very strong opinion before you here today, based solely upon the remarks that were made in the northwest corner of the room, to the effect that it was desired to maintain a custom whereby a certain fish, the whitefish, is caught mainly in the spawning season; and I just wish briefly to put these two principles before you: viz., first, that the essence of protection is to protect the spawning fish, both during the spawning season and for a sufficiently long period prior to the spawning season, to enable the roe to fully develop, and the fish to deposit their spawn; and also to protect them for a sufficiently long period to enable them to recover sufficiently good condition to attain the best price in the market.

The second proposition is, that where you have natural conditions interfered with only or mainly by the operations of man in the matter of fishing, not in the matter of other obstructions than netting to fish reaching their spawning beds, not in the matter of pollutions and other dangers to fish life, but simply on the question of fishing, that you will let nature do its work and that you should depend, to the smallest possible extent, upon artificial aids to nature. The conditions are different when you have waters that are available for the development of fish after they have been hatched and placed there, but are only so available. As an instance I will mention a well known case of one of the originally most productive salmon rivers in Europe, namely, the Rhine. In the mouth of the Rhine are the most valuable salmon fisheries in Europe. The principal waters of the Rhine, divided as you know they are among several states, are so absolutely destroyed and cut off from the spawning fish ascending from the sea that, unless artificial propagation were practiced, the Rhine fisheries would be absolutely destroyed; but in your great lakes, to take this concrete case, the whitefish have opportunities of spawning naturally, if they are not caught in undue numbers, and I do submit to you that before you take any action

you consider this matter very carefully. I may say in parenthesis, that I do not quite understand the precise steps which have led up to the present position with regard to this particular resolution; but on the principle of the matter, if you take any action which would suggest that you favor the principle of unrestricted fishing of spawning fish especially, and favor in the place of nature the artificial propagation of fish, you will be giving the greatest set-back to the true methods of fish protection that ever was given to that important matter.

Dr. Birge: I just wish to say a word and that is in objection to the arguments which have been used attempting to commit this body to the assertion of a policy in case of a negative vote on a motion to reconsider. This society has voted in favor of the protection of nest building fish. No deliverance of this body has been made as to the best methods of protecting the whitefish, whether it is by catching and taking the spawn or by protecting them during the spawning season. No deliverance has been made by this body on that question and none will be made, even though this resolution to reconsider is defeated. The only significance of that will be that this body does not choose to give a positive deliverance on that question, one way or the other. Our friend from Toronto thinks it would be wise for this body to go slow in reaching a decision one way or the other, and I coincide with him.

Mr. Titcomb: The gentleman on my right has spoken about the salmon of the Rhine in comparison with the whitefish, in connection with this resolution. I think this society is thoroughly on record as favoring the protection of fishes during the spawning season, but this resolution, if reconsidered, contemplates passing another resolution as I understand it, which involves more particularly the whitefish than any other. At this time and during this congress papers are to be read (and there will be an award for the best paper) telling how to increase the production of whitefish. Now, if we tonight act on this resolution or pass a resolution directly involving that question, it seems to me that we are hasty, and that we ought just to hear these reports that are to be read tomorrow. I happen to be on the committee of award, which will consider these three papers; so I am

talking about what I know; and I hope that the society tonight will not vote to reconsider the resolution on that account, and I call for the question.

President: Is the question on the reconsideration of the vote, or is it on the resolution?

Mr. Meehan: The vote will be on whether the report of the committee adopting a certain resolution as amended shall be reconsidered.

The question was then put and lost.

Mr. Fullerton: Our friend from England misunderstood Dr. Birge's statement about the whitefish. The only time you can catch the inland whitefish is during the spawning season.

Mr. Fryer: I think my remarks have been understood, if the facts are as stated that you can only catch whitefish in the way you mention.

Mr. Fullerton: The inland whitefish.

Mr. Fryer: If you can only catch the inland whitefish during the spawning season and if those inland whitefish are showing signs of falling off, then you are doing an absolute wrong in continuing catching them during the spawning season.

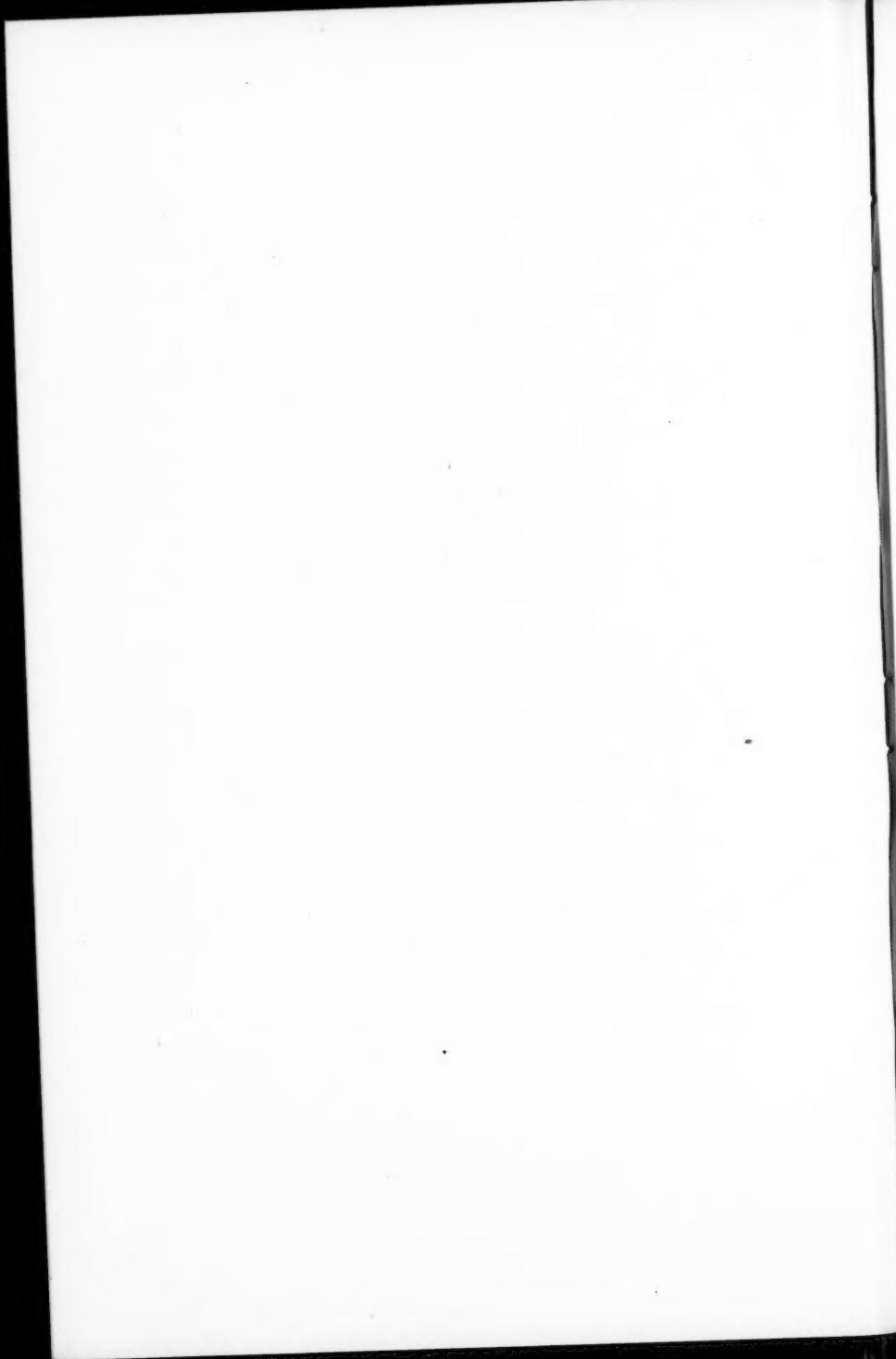
Mr. Fullerton: They are increasing by thousands.

Mr. A. Kelly Evans: If any gentleman wishes to know whether whitefish are caught today in our great lakes I will show him many menus, proving that whitefish are being used today in the Province of Ontario.

Dr. Birge: They are probably cold storage.

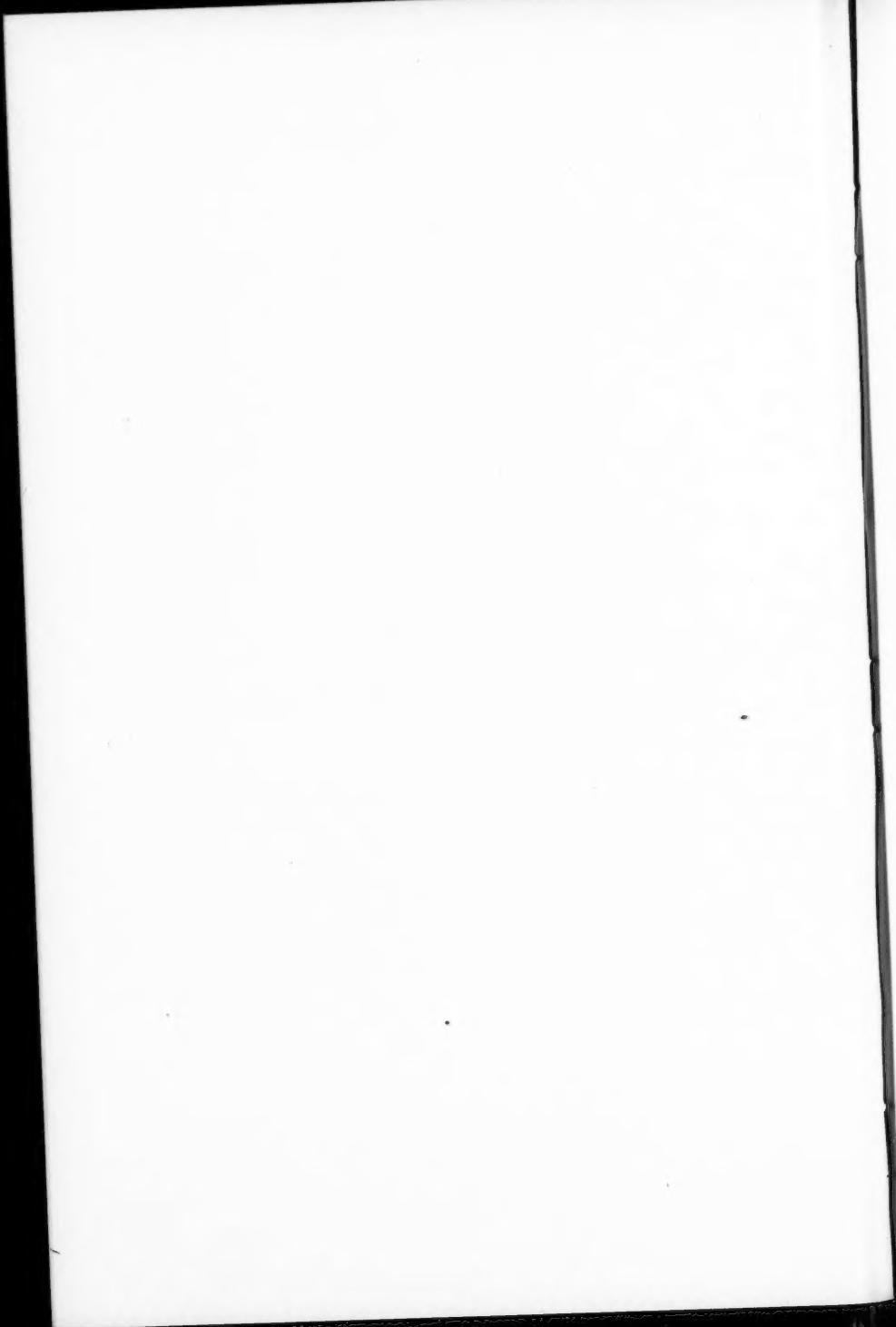
President: The papers not read are to be referred to the committee for publication.

Adjourned sine die.



PART II.

SCIENTIFIC PROCEEDINGS



ANNUAL ADDRESS OF THE PRESIDENT

Shortly after you did me the honor of electing me president of the Society, I began to make preparations to leave the country; and I was soon speeding to the remotest parts of the orient, from which I returned only a couple of months ago. If it had been the treasurer, this flight might have looked suspicious and would doubtless have continued longer, but as it was only the president, no special significance needs to be attached to it.

The United States government has shown its interest in the welfare and development of the fisheries of our most distant possessions by dispatching the fishery steamer Albatross to the Philippines for the purpose of determining the aquatic resources of the islands and pointing out the lines along which the fisheries may be improved and the financial condition of the Filipino fishermen bettered. This work is still in progress and will continue for a considerable time. On his way to the Philippines, your president made a short stop in Japan and renewed acquaintance with some of the interesting fisheries of that most interesting country; and he visited a national fishery exhibition at Nagasaki at which there were more than 28,000 special exhibits. He also had an opportunity to see something of fishing in China, and made a special inquiry regarding the celebrated pearl fisheries of Ceylon. About these foreign fisheries and the lessons they afford us, something may be said at some future meeting.

Matters of great importance connected with the fisheries have come up since our last meeting. The year has, in fact, been characterized by almost unprecedented activity in fishery work and will be found to have left an enduring impress on the history of our fisheries.

In view of the impetus this society gave to public fish culture in America, it is a pleasure to note the steady growth of this most important branch. All over the country it is receiving greater attention; new hatcheries are springing up everywhere under private and public auspices; thousands of persons every year are experiencing for the first time the benefits and delights

of private pond culture; and the proneness to overindulgence in meat is being offset by the increasing opportunities to have wholesome fresh fish as regular components of our menu. The demand for food and game fishes for stocking public and private waters is taxing the capacity of the hatcheries to the utmost, and the response is seen in a larger output in the past year than ever before in the history of the country; but the supply of many kinds of fishes is entirely inadequate, and this fact is exemplified in the insistent demand for fish hatcheries in recent congresses which culminated in a remarkable movement in the last session of the last congress, when there were presented ninety-seven bills, providing for seventy-four new fish cultural stations in forty-two states and territories, and carrying appropriations aggregating \$2,000,000.

The progress of fish culture in America, however, must not be gaged solely by the magnitude of the operations. Equally important are the perfection in methods and the enhanced efficiency of the results that have been brought about by the scientific study of the fishes, their eggs, and their food in nature and under domestication, and by the investigation of the physical, chemical, and biological characters of the waters to be stocked. Never before has the man of science co-operated more zealously* and effectively in the interests of the fisheries; and never before has the debt that the practical fisherman and the fish culturists owe to the scientist been more generally acknowledged. The necessity for scientific knowledge in the handling of fishery problems is so fully appreciated that those states which do not now have trained biologists connected with their fishery work are regarded as behind the times.

The increased attention given to oyster culture is one of the most hopeful signs of fishery advancement. The persistency and vigor with which the inauguration of oyster planting was for a long time opposed in some states was most disheartening to all who had given the subject serious study and had seen the futility of the do-nothing policy to which some of the states seemed to be irrevocably committed. The state that had the most at stake and was one of the last to recognize the benefits of oyster farming is Maryland; but having finally seen the error of her way, she has approached the subject of the restoration of her suprem-

acy in oysters in the proper spirit and has instituted a system of surveys, preliminary to the general allotment of lands for planting purposes, that for comprehensiveness and thoroughness are marvels and will serve as models for the remainder of the country. It is hoped and believed that in Maryland and other states an industry meaning so much to the citizens thereof and to the country at large will never again have to suffer because of party demands, and that hereafter oyster planting will have no greater political significance than corn planting or potato planting.

A movement that augurs most important benefits to our fish life is the national conservation commission, appointed and assigned a definite task by the president of the United States. The general and unqualified approval of the purposes of this commission on the part of the state authorities and private citizens as well as federal officials is one of the most encouraging signs of the times; and I venture the prediction that when this commission shall have made its report and recommendations it will be seen that the relations of our fish life to agriculture, forestry, mining, irrigation, and other industries are fully appreciated and that ample provision has been made for the conservation of our interior and coastwise fishery resources.

A dispute that is practically coexistent with the United States is that involving the fisheries carried on by our New England fishermen on the shores of the English colonies on the northeast coast of North America. Treaty after treaty, *modus vivendi* and *modus vivendi* have sought to define and limit the rights and privileges of the fishermen with so little result that on more than one occasion a war cloud has appeared on the horizon and gained considerable size. It is therefore a source of great satisfaction to all concerned that this long standing dispute, by mutual agreement, will now be submitted to the international arbitration tribunal at The Hague.

The apparent inability of the states to unite on measures for the protection of the fish life in the basin of the great lakes, and their willingness to have the federal government assume jurisdiction over the fisheries in all the boundary waters contiguous to the United States and Canada, have resulted in a convention with Great Britain under which an international commission has been appointed and assigned the duty of drawing up regulations

that will be binding on the fishermen on both sides of our northern border. This is the first instance in which the government has attempted to exercise jurisdiction over the fisheries in state waters, and marks an epoch in the history of fishery legislation in this country.

In conclusion, there should be named among the things that make this time noteworthy from the fishery standpoint, the Fourth International Fishery Congress, whose sessions begin in this city tomorrow. It will be recalled that this society united with the United States government in extending an invitation to the congress to meet in America this year, and the society thus becomes a joint host. With great magnanimity you have consented to curtail your regular sessions in order that you may attend the meetings of the international body. I believe that your course in this matter will be fully justified and that you will feel at the end of the week that you have had one of the most profitable and enjoyable fishery experiences in your entire existence. I hope that every member of the society will become regularly affiliated with the Fishery Congress, so that he may participate in all the functions that have been provided.

DESCRIPTION OF SAN MARCOS STATION WITH SOME OF THE METHODS OF PROPOGA- TION IN USE AT THAT STATION

BY JOHN L. LEARY, UNITED STATES BUREAU OF FISHERIES, OF SAN
MARCOS, TEXAS.

The San Marcos Texas Station is situated near the head of the San Marcos river and about three-fourths of a mile from its source, which consists of bold flowing springs, flowing from a limestone ledge some one hundred feet in height. The station comprises thirty-three acres of land and has a river front of nearly one-half mile and about eighteen feet above water level of river, the grounds being located east of and adjoining the town, a street being the dividing line, and are quite picturesquely situated just below a range of hills one hundred feet above the general level of station, the hill just back of the station being crowned by a very handsome state building known as the Southwest Normal School of Texas, accommodating about five hundred students, and makes a fine background to the station, which, with its miniature lakes, makes a pretty foreground, the two making a picture which I call the gem of southwest Texas. Of these grounds we have nine acres devoted to twenty-three ponds, varying in size from fifty by fifty feet to one by one and one-fourth acres, all being designated by letters or numbers. Each pond has a separate inlet and outlet. The inlets are provided with gate valves, and the outlets or standpipes are of brick and cement, open fronts, screened with perforated zinc screens which I have found to be most efficient. The perforations being one-sixteenth of an inch, both screens and dam boards fit into slots provided for in the mason work. The supply pipes are from four to six inches as to size of pond, and the outlets from six to eight inches, leading into drain pipe twelve inches in diameter. All pipes, both supply and drain, are laid under ground, and consist of Michigan pine, terra cotta, and iron, the iron being preferred as they never become clogged with roots which will permeate both the

wood and clay pipes and at times giving serious trouble. The water supply consists of one artesian well, with an average flow of about five hundred gallons per minute, and a ten horse power gasoline pumping plant. This plant gives after two years use, six hundred gallons per minute, the two supplies giving barely enough to supply the twenty-three ponds, owing to the fact that we have nearly nine months of summer.

The station was fitted up for a black bass station, water conditions being quite suitable for the large mouth variety, they only being propagated and with them we have been quite successful. We also propagate the two crappies, bream, warmouth bass, and rock bass, all doing well except crappie; the water conditions of the station seem unsuited to their propagation.

We have also tried to propagate the blue channel catfish for the past three years, but have met with total failure. On coming to this station some twelve years ago I had made up my mind that 1,000 shipping fish to the pair of breeders would be a fair result (I mean by shipping fish—young fish from two to six inches long). I now think that sixty per cent of that number is a fair average, however, our plants of fish two to six inches have been wonderfully successful, in fact we have not met with a failure to stock any waters where we have made plants of black bass. With our perch, excepting bream, we have never had abundant results. This is caused to some extent by devoting a small water area to their propagation and this has been caused by the great demand for the black bass.

The method of work pursued at this station is to conform as near to nature as possible. The ponds were constructed so as to have the largest area of shallow water, thus securing in early spring an abundance of natural food, and protection for our young fish, and all breeding ponds are provided with gravel nesting places. I at one time provided artificial nests, with varying success. These, with other experiments, their failure and success if told would take up too much space in this paper. I have found that the first great essential is to provide the very best breeding fish to start with. Not the very large and possibly old fish, but fish that will run from two and one-half to three pounds, well proportioned; not the long race horse kind. Fish, like everything else have their fine points. The nearer they are of

one average size, the better. One other thing I find helps in pond culture and that is to infuse new blood as it were into your breeding ponds. That is, each year introduce a fair per cent of wild fish into your ponds, discarding all breeders that have a rundown appearance. The number of breeding fish will vary with climatic conditions. In this climate—southwest Texas—I say that sixty good breeders to the acre of water surface seems about the right number. Where the climate is cooler and ponds deep, this number might be doubled to advantage.

We have two seasons for the distribution of young fish from the San Marcos Station, the distribution of black bass commencing in the spring about the middle of April, and extending to July or August, and as soon as the fall sets in, giving cool weather, we distribute all bass left over, our crappie, rock bass, bream and other fish. Most of the bass shipped from this station run from two inches early in the season to six and eight inches in the later part of the season. Fish of this size being quite acceptable to applicants, they get fewer in number, but with a positive certainty of satisfactory results in stock waters planted.

In collecting young fish from our breeding ponds for shipment we use a seine made of bobbinet, rigged in the same manner as the large drag seines are for commercial fisheries. The young fish, seined from the breeding ponds, are assorted and placed in shipping pools. These pools are constructed of brick and cement, six by sixteen inches and two feet deep, provided with valve inlets, and six inch outlets, and can be emptied and scoured in a few minutes. From these pools the messenger takes them, carrying of the smaller size, two hundred and fifty to the can, or of the large size, fifty. During transportation the messenger seldom changes water, but uses ice to keep the water temperature down to sixty degrees, and under these conditions even in our summer climate seldom loses a fish, and the general report of applicants is, that fish are received in good order, and later that results are satisfactory. We supply with the station force over four hundred applicants each year, and artificial lakes and ponds in the state are on the increase, creating the need of another station in Texas.

I have brought some photographs of my station in connection with this article, showing our grounds and pond system, and will

say that we have one of the most attractive spots in Texas, apart from the pleasure we are giving to sportsmen, and the economic good we are doing. It is an oasis, you might say, in the midst of this sunburnt country, at least it looks and feels that way to me.

DISCUSSION.

John W. Titcomb, Washington, D. C.: I note what Mr. Leary says about his total failure in the attempt to propagate the blue channel catfish. The bureau has attempted to propagate this species of catfish at five or six different pond stations and carried the brood stock for a number of years without any result whatever. Apparently the fish spawn in a rapid flowing stream or in the current of a stream under the river. Mr. Worth has made some experiments, and Mr. Leary's failure is not the only one. I think the value of his paper would be enhanced if he would explain, as I am sure he can, why the crappie is a failure there.

Mr. Leary: In the first place, the conditions for crappie are not such as they usually breed under. Crappie usually breed in roily water, and our water is clear. I have succeeded, however, in raising crappie by introducing carp with crappie, which roil up the water, and I have raised some thousands of crappie in that way. I have also resorted to nearby cattle tanks and stocked them with crappie, and I have got fair results from stocking such ponds. These ponds are supplied by rainfall and the water seems entirely suited to their propagation.

Mr. S. G. Worth, Beaufort, N. C.: It would appear that the spotted catfish has been actually propagated by the government. Since I was in Tennessee engaged in that work under Mr. Titcomb, I have discovered that the annual report of the United States Fish Commission for 1892 and 1893 shows that Dr. Rudolph Hessel, late superintendent of the carp ponds, Washington, hatched thirteen hundred of those fish; and they were distributed through the central station, of which I was then in charge, and are recorded in the table of distribution by their name and also by the scientific name, and in view of the numerous failures that have taken place, it is rather encouraging to think that some were actually hatched, and especially under Dr.

Hessel, because we know that he was a very accurate man in his work, and I think that the history referred to is worth looking up.

Dr. James A. Henshall, of Montana: What crappie did you experiment with, the *sparoides* or the *annularis*?

Mr. Worth: Both.

Dr. Henshall: I would only state that in the middle west in Kentucky, the *annularis* always spawn in clear spring ponds, as does the calico bass or the *sparoides* in the lakes of Wisconsin and Minnesota. Those lakes are always clear and the fish spawn naturally. Of course, it makes some difference in case of domestication.

President: Will Dr. Evermann say a word in regard to the catfish from the biological standpoint, and the possible cause for failure of artificial propagation?

Dr. Barton W. Evermann, Washington, D. C.: I do not know that I could say anything that would help the matter at all. I am not very familiar with the spawning habits of the channel cat or the spawning habits of the blue cat of the Mississippi valley, and I take it that in the experimental work in the station, or fish cultural work there, it is desirable to propagate both of those species, and probably the difficulties which you would encounter with the one would be essentially the same as those which you would encounter with the other. In the years that I spent in the Mississippi valley, it was my observation with both of those species of cat (particularly the channel cat) that while they would live in the moderately swiftly flowing streams, such as the Wabash, we would find them in the spring of the year at spawning time, in holes in the banks of the streams. It was quite a common thing for us to go after the channel cat in that way, and in the spring of the year to find it in the holes in the banks, and the supposition was that that was its spawning place. I do not know that that is correct, but it may be. At any rate that may offer a suggestion as to the habits of the fish.

In all of this work it is of the utmost importance, I think, that we should know what species we are dealing with. As Dr. Henshall raises the question regarding two species of crappie

and calico bass, the habits may not be the same; in fact, in most cases we know that they are not the same, and we should be very sure that the species that we *think* we have is the species that we really have. We all know, of course, that it is very difficult to determine some of the species of catfish, particularly the common black bullhead and the common bullhead, the *ameiurus nebulosus*, as distinguished from the *ameiurus melas*, and sometimes shipments have been made of some of the little stone cats under the impression that they were yellow cats, or that they would grow to be important commercial fishes; so that the only point I want to make is that we should be sure of the species that we have in hand.

Dr. Henshall: I endorse what Dr. Evermann has said about the catfish making holes in the bank. I presume all of them do that.

Mr. Worth: The catfish from an economic fish cultural standpoint, has interested me considerably, more especially since I have noticed that Dr. Henshall claimed to have hatched them, and that fact taken in conjunction with the statement of Dr. Jordan that he regards catfish as being as good a food fish as the blass bass, makes the subject an important one. For my own part I do not care for catfish, but I know that it is a good food fish in a general way; and the point that I wish to make is this: It seems that as a rule, as a general thing, the spotted catfish cannot be propagated in ponds, but under exceptional conditions that it may be successfully propagated. Now if that is the case, if it can be propagated and does not ordinarily reproduce itself in ponds, it gives that fish an advantage over any other representative of the finny tribe that we have in the United States. It gives us a good food fish that will take a miscellaneous diet and that will not reproduce while we are feeding and growing it to table size.

President: The chair will state that the introduction of the spotted catfish and the fork-tail catfish of the Mississippi valley into the Potomac river has proved one of the most interesting and important experiments in acclimatization that we have undertaken. A few fingerling spotted catfish were placed in the Potomac river near Washington a number of years ago, and in

due time the anglers began to report the capture of fine specimens of a catfish that they were not familiar with, and three or four years later they began to catch another species of catfish also strange to them, and when we secured specimens it was found that they belonged to a species of which we had no record of introducing. So that the probability is that there were young fork-tail cats with the spotted cats. Now these fish are caught in large numbers by anglers above and below Washington, but more particularly in the swifter part of the river above the city, and I believe I am safe in saying that there are few fishes known to the sportsman of this vicinity which are more popular than those big cats from the Mississippi basin. They take the artificial fly almost as readily as the black bass, and as a food fish they have few superiors.

THE INCREASE OF WHITEFISH AND LAKE TROUT IN LAKE ONTARIO

BY CHESTER K. GREEN, UNITED STATES BUREAU OF FISHERIES, OF
CAPE VINCENT, N. Y.

There has been such a marked increase in the catch of whitefish and lake trout in the waters of Lake Ontario, in the vicinity of Cape Vincent, N. Y., due to the work of the Bureau of Fisheries, at this point. I concluded that a few facts and figures which have been gleaned from the fishermen and fish dealers would undoubtedly prove of interest to this society.

The actual results of the work conducted by the bureau did not make itself manifest to a perceptible degree, until the season of 1907, and the increase for the season of 1908, has been still more remarkable.

From the branch of the A. Booth Fish Co., located at Cape Vincent, I have obtained the following comparative figures showing the quantity of fish received by them from the fishermen on the American side. From January 1, 1907 to December 31, 1907, whitefish, 1,128 pounds; lake trout, 1,608 pounds. From January 1, 1908 to September 15, 1908, whitefish, 5,765 pounds; lake trout, 4,864 pounds, showing an increase of 4,628 pounds of whitefish and 3,256 pounds of lake trout, with nearly two months fishing remaining to be accounted for this season. These fish were taken principally in the vicinity of Grenadier Island, located about eight miles from Cape Vincent, and practically with one set of nets.

The Booth Company have also informed me that from the Canadian waters in close proximity to Cape Vincent, they have received more than five times as many whitefish and trout this year than last, and last year's catch greatly exceeded that of any previous season for a dozen years or more. I had arranged with the company to give me the exact figures up to date, but owing to the unfortunate turn in their financial affairs, they were unable to collect the data. In order to present some definite figures, however, for a stated period I herewith reproduce the following

extract from my last annual report to the Commissioner of Fisheries. The A. Booth Fish Co. report that the increase of whitefish and trout in the waters of this vicinity over last season has been remarkable, and have given the following comparative figures of actual weights for a stated period.

Whitefish and lake trout received from April 1 to June 10, 1907, 30,523 pounds; whitefish and trout received from April 1 to June 10, 1908, 120,905 pounds. I am informed that the same rate of increase has been maintained during the entire season.

The fisheries from which a large percentage of these fish were produced, are located at the Duck Islands, about twenty-five miles southwest of Cape Vincent, and very close to the American boundary line, and from twelve to sixteen miles from where large deposits of fry have been made annually during the past twelve years.

It must be remembered that there is not at the present time one fisherman on the American side to at least twenty or thirty on the Canadian side, and therefore we have no means of knowing to just what extent our fisheries have been benefited.

Last season the bureau secured from Three-Mile Bay, N. Y., about seven miles from Cape Vincent, 720,000 whitefish eggs. These were obtained from adults produced from fry distributed from the Cape Vincent station, and represent the first whitefish eggs taken in this vicinity in many years. There was but one net in operation last season, but owing to the encouraging prospects, there will be prepared four large nets, for use this season, with which it is anticipated much larger results will be obtained, and thus demonstrate the practicability of securing large supplies of whitefish eggs, for the purpose of artificial propagation.

The laws of the state of New York, now provide for a close season for whitefish, from November 1 to January 1. The Forest, Fish and Game Commission have, however, granted permission to the fishermen at Three-Mile Bay to take whitefish during the month of November, for the purpose of collecting the spawn. The state commission will also co-operate with the bureau in the matter of the distribution of the fry, extending this work to the depleted fisheries of Lake Ontario from Chaumont Bay to Oswego, N. Y.

There has also been an excellent showing made from the plantings of pike perch fry in this vicinity. Last fall two hundred pounds were brought in at one time by a licensed fisherman, and several fine specimens have been captured with hook and line during the past summer, one of which weighed six and one-half pounds.

It is gratifying to note that the value of the work of the bureau is fully conceded and appreciated by the fishermen and dealers. They are thoroughly in accord with the aims and objects of the commission, and in some instances are taking measures to regulate the size of the mesh of their nets. It is hoped that all may be induced to do so, and thus prevent the catching of undersized fish, and the marketing of the same.

VALUE OF CARP AS FURNISHING FOOD FOR BLACK BASS

BY DR. S. P. BARTLETT, UNITED STATES BUREAU OF FISHERIES, OF
QUINCY, ILL.

In discussing this proposition I wish it understood that I deal with the conditions present in the Mississippi and Illinois river business in Illinois. That there may be a variation in conditions in other localities is probably true, but I know of no better place to show possible practical results from the introduction of the carp for purposes given in the title, than in localities named.

I am aware that what I say may be considered as emanating from an enthusiast on the question, or perhaps to put it plainly, it may be thought that I have said so much about the carp and its general value, that I believe it myself and therefore do not hesitate to state it as a fact. I am, however, pleased to know that time has demonstrated beyond question, that the United States Fish Commission did a good practical job when carp was introduced in waters named.

For a moment I would like to consider the conditions present when fish are taken from the overflows and natural lakes and ponds. My observations have been that a very large percentage of coarse fish are always found in such places when the water becomes very warm during the summer months, say eighty-five per cent of coarse fish which would include carp, buffalo, bream, catfish, shad and the minnows, to fifteen per cent of the various varieties which would include bass, pike or pickerel, crappie, perch dogfish and gar, and I believe these proportions are nearly or quite maintained in the rivers proper. These conditions, I believe to be natural and for a purpose, namely, the coarser fish to supply food to the gamier. If I am correct in this proposition, the necessity for a great amount of food supply exists in order that the bass and other live feeders may be maintained and failing in such supply, naturally consume their own fry and so far as possible, each other.

Way back in the sixties, buffalo furnished the bulk of coarse

fish taken for shipment for market and the rolling or spawning season was the harvest for those engaged in commercial fishing, and the catches along the Illinois and Mississippi rivers were immense, and the product sent to St. Louis and other outside markets by steamboat usually packed in large sugar hogsheads and barrels. I can remember of seeing shipments so large that in spite of the perishable nature, only a part of the shipment could be taken. A large proportion of these fish were lost as little or no ice was used, the boats making the trip usually during the night. The fish were as a general thing consigned and account sales very frequently showed so great a loss that freight charges were not realized.

While the slaughter, for such it was, was in progress, the catch of bass, pike, pickerel and crappie was very large, immense quantities shipped all through adjoining states to good market.

In 1870 to 1880 the decrease in supply of buffalo was marked, in fact, had decreased to an extent that most of the larger fish dealing companies had gone out of business. The bass were notably scarce, pike and pickerel practically extinct and all game varieties had greatly decreased. Attention had been called to the matter by this time and in the early seventies legislative action was asked for and some tentative laws passed covering spawning seasons. The harm, however, had been accomplished and fish were scarce.

Then came the introduction of the carp. Carp increased, so did the opportunity for "cuss words" and complaints without number, that the carp were destroying and driving out game fish, yet carp increased, so did the bass. Carp furnishes the great bulk of commercial fish and bass are more plentiful than ever known on Illinois river. On the Mississippi river, owing to the peculiar conditions of the overflows, not so general or complete, the banks being as a rule higher, carp have not shown nearly so rapid an increase and bass equally as scarce.

It might be well to give a few of the facts gathered in the years I have spent along these rivers, to show why I attribute the increase of black bass to the increase of carp, or in other words, increase of food supply. As stated under natural conditions, the percentage of coarse to fine fish is largely in favor of the coarser varieties, and this has been a notable season along these lines.

The Illinois river was high and out of its banks all fall of 1907, and remained so practically all winter, and in fact, all of spring of 1908. This gave an opportunity for general spawning of fish in the back waters. The season showed up with great quantities of black bass fry from off the nests fairly early, when water had receded to an extent that made collections possible, we found great quantities of yearling bass, but in such places as we found the yearling bass we found no fry, or in very limited quantities, and when fry of 1908 were found in quantities, we found no yearling or large bass. In the river proper along the shores, one and two year old bass were taken anywhere on hook and line and in great quantities, and the fry of the carp notably scarce.

Some immense catches were made. I note one particularly. Three men took in three hours, at the mouth of a slough running out from one of the flat lakes, 375 black bass, from one-half to three pounds in weight.

These fish were brought up to Meredosia and cleaned. I had an opportunity to examine the stomachs of a large number and I am safe in saying that the large percentage of food found in them could be recognized, was of carp fry. The carp, of course, spawn anywhere and the deposit of spawn great, making it possible not only for a reasonable percentage of fry to escape and reach maturity, but furnishes at same time a great amount of food for other fish and it is presumed the bass get their share of them and anything else handy, not overlooking when hungry, their own young.

There is perhaps no need to say to you who have had as much experience as I have had, that black bass are live feeders and feed to feed and not for fun. An instance or two that may furnish a straw in support of the theory advanced.

One season (date not in mind) while collecting bass for the United States Fish Commission at Meredosia, we concluded to use for storage purposes a spring pond situated near our plant. This covered perhaps a half acre, and while well filled with brush, we tried to clean it out and did take out quite a number of adult black bass and we found that the pond was well supplied with bass fry of the spring hatching, just off the nests. Mr. Bawr made an estimate of the fry at 50,000. We were making

collections then at or near Copperas Creek dam, some distance above Meredosia, by use of a small steamer and had taken from one large flat lily pond about 40,000 bass fry. As I remember it now, Dr. T. H. Bean, at that time with the United States Fish Commission, was with us on one of the down trips. We put the fry so collected into the spring pond to hold until cars were available for distribution. Some weeks after we drained the pond as best we could to take the fish out for shipment and we found 5,600 good fat bass fry as the remnant of the 90,000 (estimated 50,000 and counted 40,000) that we should have had.

At another time, I put in the fountain basin in Washington Park, Quincy, 12,000 black bass fry, taken from Quincy Bay, all sizes. We were not ready to ship them and had no other means of holding them here, except in life box. Here we had a constant supply of running water. I had men take from the bars in the river, what I estimated at 100,000 shiner minnows and feed them together with an occasional feed of beef liver. I do not remember of taking out a dead bass, but when we had arranged to ship them and the basin was drawn down we took out less than 1,500 bass fry, fat and slick, and not a dead fish.

I quote these instances; two, of a great many that have come under my observation, to show the great need of plenty of food for the bass under any condition and when under natural conditions largely furnished by the carp, reduces the destruction of its own spawn by the adult bass or other various species.

While this paper should be confined to the subject, I cannot refrain from digressing a trifle and calling attention to the fact, that in my opinion, not enough care is used by those making the attempt to cultivate bass in small ponds to get a proper balance in the ponds in the way of food producing facilities and some very lamentable instances could be given showing failures when only black bass culture was attempted.

It would be well to remember that while I have much to say of the black bass that is good, I have more to say of the carp that is better, when the people as a whole are considered.

With us the angler goes his length on the black bass, and they who can afford day or days of leisure to cast a fly, troll a spoon, or "dub fish" with a minnow; should give due credit to the causes that make this sport possible and not overlook the thousands

who cannot afford rod or net, fixed bait or even minnows, who sit on the bank content to catch, with such tackle as he can get and such bait as may be procured without cost, this same carp, for food for himself and food for the fish the angler fishes for.

DISCUSSION.

Secretary Peabody: This is one of our most interesting subjects, gentlemen, and has heretofore provoked considerable discussion.

President: It out to be explained that the subject of carp has been tabooed in the American Fisheries Society for several years, and Dr. Bartlett has taken advantage of the withdrawal of the prohibition to let us hear from him on this subject.

Dr. Bartlett: I hope the members will not take it that I should be affronted if they criticise the paper, or criticise it severely. I have been used to that for a great many years. I want to say that I have lived long enough to see all of my efforts perfectly justified, not only in my own state but in a great many states surrounding, and I have this to say, that the United States Fish Commission never did a better job on earth, that produced more food for less money than when they introduced the carp in the waters of the state of Illinois.

Dr. Barton W. Evermann: I have recently passed across the continent from New Brunswick to Vancouver Island and heard the carp damned every day. I thought the damning that the carp received on the American side was severe, but it is mild compared with that which you hear across the border. No one in Canada has a kind word for the carp. No one seems to know anything about the carp except to make the unfounded statement we have heard so often, about its destructiveness in various ways.

On Lake Erie the fishermen are getting more carp than all other species combined, and are getting more money in the aggregate for the carp than for all other species combined, or for any other species, throughout the year. A little later on the upper Mississippi river near Dr. Bartlett's own home, the fishermen were catching little but carp at the end of August and early days of September, and although they were getting but three or four cents a pound for it, it was bringing more money than they were

getting from all other fishes, so they have said. There are those who will tell you that the carp is destructive, that it eats gallons of eggs of whitefish and all other fishes, but such statements are usually very recklessly made. One person showed a carp which he said had a gallon of whitefish eggs in its stomach in June. (Laughter.) The eggs were not whitefish eggs, but were the carp's own eggs, (laughter)—not that it had eaten them, but they were in proper place—a little delayed but still there. (Laughter.)

President: We have with us today a number of gentlemen who can tell us a good deal about the carp and its destructive habits in Europe, and I am sure it will be a great pleasure to the society to hear from one or more of these gentlemen. I would like to call on Dr. Hoek for a brief statement of the attitude of the European public toward the carp in open waters so far as the destructiveness of the fish is concerned.

Dr. P. P. C. Hoek, Holland: I should like to give you an answer, but I cannot, as I am not sufficiently acquainted with the habits of the carp. But perhaps Dr. Nordquist may know.

Dr. Oscar Nordquist, Lund, Sweden: In Sweden we are doing all that we can to increase the carp, but I must tell you that the carp does not spawn there in free waters in the lakes. We cannot get it to spawn in any other way than in small ponds built just for the spawning of the carp, but we never have noticed any destructive qualities in the carp. We consider it to be one of the best fish we can introduce. It is possible that in climates warmer than ours carp propagate more rapidly than with us, but there it does no harm. There is no fish I think, which can utilize the food, existing in a lake, so well as the carp does, but that I think is the only way in which it can do harm to other fishes. I have seen in American papers that by roiling and making the water muddy it may do harm, but that we have never noticed in Sweden, and that is the only thing I can say. We consider the carp a very good fish.

I think the reason why people have got an antipathy for the carp is that they eat it directly from muddy water, and that of course is a great fault; for if a carp is taken out of muddy water and brought directly to the kitchen it of course has a muddy

taste; but you have to put it in clear water and keep it there alive for some weeks and then the muddy taste disappears, and it is just as good a fish as any other. The same holds true of a lot of other fishes; if you take them directly from muddy water they have a muddy taste. That is the only explanation I can give why the carp are so disliked here in America.

Mr. Charles G. Atkins, East Orland, Me.: Let me suggest that carp is probably condemned in America without a fair trial; that of ten thousand who condemn the carp probably not more than two or three have ever tasted one. People make up their minds without trial, or knowing what the truth is.

Let me make another suggestion, whether the carp is not really good enough to be considered as a fish worth growing for its own sake instead of merely to feed other fishes, and whether it would not be worth while to try to start with the production of carp and not use carp up in the feeding of other fishes that in the end are no better. Rather than use ten pounds of carp to produce one pound of bass, would it not be better to utilize the ten pounds of carp, and then we would have ten pounds of good fish instead of one pound? I ask whether it would not be better for us to abstain from so much cultivation of the predaceous fishes at the expense of the more peaceful fishes like the carp?

President: We have heard from northern Europe through Dr. Nordquist; we would like to hear from southern Europe through Dr. Vinciguerra.

Dr. Decio Vinciguerra, Rome, Italy: In Italy the carp is little appreciated and is not cultivated. A certain Austrian gentleman tried to cultivate carp in northern Italy, and though he met with success in the culture he failed in the trade of the fish, because the fish was too expensive for the common people; and he could not sell in Germany because the distance was too great; I think he gave up his ponds.

SOME POINTS IN THE MIGRATION OF PACIFIC SALMON AS SHOWN BY ITS PARASITES

BY HENRY B. WARD, OF THE UNIVERSITY OF NEBRASKA.

The Pacific salmon manifests some strange features in its life history which are of such interest as to call for whatever evidence can be secured to establish their precise character. Two years ago through the courtesy of Commissioner George M. Bowers of the Bureau of Fisheries, I had the opportunity of spending a summer in Alaska investigating the parasites of the salmon. My sincere thanks are due the bureau and Commissioner Powers for this unique opportunity to study a most interesting subject. While the large amount of material collected there has not been put in final condition for the complete report and in any event would be rather too extensive to warrant repeating it here, yet there are certain results of such general interest that they may properly be presented on an occasion of this type. This is all the more true since they cast a most interesting light on the comparative biology of the Atlantic and Pacific salmon.

It is possible to gather from the parasitic fauna of any animal clear evidence of its habits. Even though the knowledge be incomplete one may demonstrate some of the changes through which the animal has passed. In fact the parasites of any animal will show clearly the range of its dispersal, the period of development it has reached, the character of its food material, and the type of medium in which it lives. Whatever changes, usual or exceptional, are experienced during its career leave a record of their character in the list of its parasites.

To illustrate this it is only necessary to cite one or two interesting examples in order to place clearly before your minds the general principle I have just stated. In 1899 Linton found that eels caught in the sea harbor parasites which are primarily marine in origin and secondarily of fresh water type. Even more striking is the observation of Zschokke (1902) in his studies on the lawyer (*Lota vulgaris*), which is the only fresh wa-

ter representative of a great marine group, the codfishes. The lawyer is parasitized by a few species found in hosts that are confined to fresh water. On the other hand it shelters many parasites that are characteristically frequent in marine fishes and usually absent among fresh water hosts. Thus though a time interval of unknown length has intervened between the present and that period in which the lawyer established its fresh water habit at yet it shelters parasitic forms which are characteristic of its old associates and has acquired little new infestation from its fresh water home. The records might be multiplied but they indicate clearly that a study of parasitism will yield valuable evidence to confirm or reject proposed hypotheses with reference to the origin, migration, and habits of our fresh water fish. It should accordingly be looked upon as a biological criterion of the most useful type. The primary object of this paper is to consider the side light which a study of its parasitic fauna throws upon the migrations of the Pacific salmon so far as they are instance in Alaska.

Apparently no records have been published concerning the effect of migration on the parasites of fishes with the exception of those given by Zschokke and others who have worked upon the migrations of the European salmon. The results Zschokke obtained are presented in three papers (1889, 1891, 1902) and give a most comprehensive review of conditions in the case of the Atlantic species as observed on the shores of Europe. If I may be permitted to follow somewhat closely his account, the case stands as follows:

Richly laden with parasites the Rhine salmon, *Salmo salar*, enters upon its journey in fresh water. In the course of its wanderings it loses more and more these parasites which inhabit the open intestines below the pyloric coeca; and since it fasts while ascending the Rhine, and thus the door for the invasion of parasitic worms is closed, it secures no fresh supply. Even thus the salmon at Basel affords an unusually rich booty of parasites, harboring more than twice as many species as any fresh water fish at that place. There still remain in the fish the inhabitants of the anterior part of the alimentary canal and those which can retire there so that parasites which in other hosts inhabit only the intestine, occur in the stomach and oesophagus of the Rhine

salmon. To such must be added also those forms which lie in the pyloric coeca with their rich store of reserve food as well as others which are encapsulated in various parts or move about freely in the body cavity or other closed organs. But even those parasites in the oesophagus, stomach, and pyloric coeca appear to decline in number of species and individuals as the fish remains longer in fresh water and climbs higher in the streams. Finally the salmon harbors only the encapsulated forms and those lying in various entirely occluded organs. The wandering in the Rhine constitutes thus a cure for the elimination of parasites from the alimentary canal. Some investigators, indeed, though without the exact knowledge afforded by these demonstrations of Zschokke, have proposed to explain the migratory instinct of many fishes on the basis of the necessity of relieving themselves of parasites acquired in the ocean.

The salmon which ascends the streams from the Baltic sea feeds abundantly in fresh water and harbors accordingly some fresh water parasites while the intestinal region does not become free from parasitic infestation. It possesses even a richer parasitic fauna than the Rhine salmon.

Other somewhat less extensive observations yield evidence of the same type. Thus the Elbe salmon according to Fritsch (1894) takes absolutely no food and in a corresponding way is infected by a parasitic fauna of a purely marine type. Over against this must be placed the record of McIntosh (1863) that the Tay salmon does feed to some extent during its migrations in fresh water. Even here the marine element preponderates, and yet there are not wanting a few parasites recognizable as guests which normally frequent fresh water fishes. In the Tay salmon also the parasitic fauna is numerous and varied. It embraces a considerable number of forms which occur in the intestine behind the pyloric coeca just where it will be recalled the Rhine salmon is entirely free from parasitic infestation. Both this infestation of the intestine and the large percentage of parasites which may be characterized as fresh water forms are regarded by various authors as clear evidence in support of the fact that the Tay salmon unlike its relative of the Rhine does not cease taking food when it enters fresh water. Consequently the marine elements in its alimentary canal are gradu-

ally lost and are replaced in part at least by the fresh water intruders. The parasitic fauna of the Tay salmon becomes thus altered during its migration but is not so greatly reduced in numbers as in the case of the salmon from the Rhine.

These observations upon the Atlantic salmon in different streams indicate clearly that as a certain individual it is characteristic of the parasitic fauna of the same host taken in different localities. This fact seems to have escaped emphasis at least at the hands of previous investigators. They have been most strikingly impressed by the fact that the parasitic infestation reaches the minimum when after spawning this salmon starts on its return to the sea. Elsewhere I have called attention to the interesting biological parallel between the later condition and that of the hibernating frog and marmot. In general one may say that the reproductive period constitutes the terminus of a physiological cycle and the host starts on its new cycle unencumbered by the parasitic guests of a former period.

In view of these interesting results from the investigation of parasitism in the European salmon you will understand with what pleasure I accepted the courteous invitation of Commissioner Bowers to investigate the parasitic diseases among the Alaska salmon. While the European work was all done on a single species, *Salmo salar*, in which local races or varieties are recognized by some students, the Pacific salmon appears in five species of more or less common occurrence and commercial importance: the King salmon (*Onchorhynchus tshawytscha*); the Red salmon (*Onchorhynchus nerka*); the Cohoe or silver salmon (*Onchorhynchus kisutch*); the Humpback salmon (*Onchorhynchus gorbuscha*); and the Dog or Calico salmon (*Onchorhynchus keta*). In my work especial attention was paid to the Alaska or Red salmon which is the most abundant and most important commercially of those species in the Ketchikan district in which I was located. A total of one hundred and thirty-eight specimens of this fish from various portions of the district were examined from the time at which the fish appeared early in June up to the time of spawning about September 1. The material examined included such as was taken from salt water and also specimens from fresh water lakes at different periods of time so that the series would give a reasonable view of the con-

ditions at the time when this fish first appears on the coast together with the changes which might be experienced through its migration and stay in the lakes preliminary to entering upon spawning. The number examined was large enough to enable one to speak definitely regarding most of the facts observed. On the other hand the number of individuals examined from the other species, namely: 31 humpback, 21 silver, 10 king, and 9 dog salmon, is too small to establish accurately the facts concerning them. So far as one can observe generally the results substantiate those obtained from the examination of the red salmon.

It has been stated by various authors that these five species have generally similar habits and food and it is rather striking that in spite of this agreement they manifest marked individuality with reference to the parasitic species which they harbor. One is inclined to think that the cause may be a difference in range during the long unknown life in the deep waters of the ocean from whence these fish come suddenly into the estuaries at the approach of the spawning season. The difference in the parasitic infestation of the species indicates clearly that in some way they carry on a different mode of life. The evidence at present at hand is insufficient to decide whether they actually use somewhat different types of food or whether they seek this in different regions.

The first specimens which are caught early in the year either in the salt water or in the brackish water of the estuaries frequently have the stomach filled with recently ingested food. Among twenty-five such specimens only seven had any parasites in the intestine while of ten, entirely without food in the stomach, nine had parasites in the intestine. A month or more later it was impossible to recognize in any case definite masses of food in the stomach of the red salmon. Yet about the same percentage of the whole number harbored intestinal parasites. Apparently then the taking of food or the cessation of feeding has in this case little or no influence on the presence of parasites in the intestinal canal. One may proceed, however, one step further along the same line. Red salmon were taken during July and August from fresh water lakes where they were waiting and ripening for the spawning period, and these individuals showed the same variability and the same relative degree of parasitic

infection in the intestine as those which were taken from salt water at the beginning of migration. I should note in passing one apparent exception to this rule. The red salmon taken from salt water contain occasionally specimens of a large tapeworm closely related to *Bothriotaenia infundibuliformis*. This species was not found even in a single case among the specimens taken from fresh water. Summing up then the results of the investigations on the Alaska salmon in this particular one may say that intestinal parasites are variable and infrequent at all times. Contrary to the findings of Zschokke for the Rhine salmon the parasites do not disappear from the intestine at any time in the migration, with the possible exception that this single large cestode seems to be wanting under conditions of fresh water existence.

Such parasites as exist in the pyloric region are apparently not affected by the migration although the large cestode previously referred to was not found in those hosts which had attained the fresh water lakes in the vicinity of the spawning grounds. Since, however, this species is not frequent in any series of specimens representing this host, its absence at the end of the migratory period may be entirely without significance. Parasites of the stomach and oesophagus are as varied in species and nearly as abundant in numbers at the close of the migratory period as they were at its outset. Furthermore, I am unable to find that these organs shelter during the fresh water existence any of those species which at an earlier time inhabit the other posterior portions of the alimentary canal. Consequently so far as the Pacific salmon is concerned its migration does not affect appreciably the amount or variety of its parasitic fauna. The parasites of the body cavity include an interesting and abundant form which is not known to occur elsewhere. This seems to be as numerous and as active in the fish on entering the spawning grounds as in the fish from salt water. Numerically it constitutes one of the most important elements in the parasitic fauna in the Alaska salmon and has no parallel in the forms hitherto reported from the European salmon.

As in the case of the Rhine salmon, so the individuals of the Pacific species are reported not to take food after they leave the salt water. In my examinations I have not found food mate-

rials in the stomach except in rare cases when I detected some small objects not necessarily of food character which had apparently been swallowed by accident. The alimentary canal becomes highly modified in appearance during the period of migration. At first one finds considerable quantities of white mucus present. This becomes much reduced in volume and changes until only a little more fluid material remains and this is of a greenish hue. These changes have no apparent effect upon the parasitic fauna. Those forms which were present at the start were still present at the close of the migration. To be sure in some fish which were examined last or which apparently had been longest in fresh water I discovered a few cestode larvae which seemed to be of recent introduction but this, which may be designated as the fresh water element, was relatively insignificant. The forms were small in size and never more than few in numbers.

In one respect the aspect of the salmon changes markedly. After a stay in fresh water it acquires regularly large numbers of a parasitic copepod, which line the oral cavity and gills. I have never seen a single specimen of this on a salt water fish. It may be regarded as a striking fresh water contribution to the parasitic fauna of the Alaska salmon. Of course this gill parasite has no relation to alimentation since it is introduced during the acts of respiration and fastens itself to the mucous membrane of the mouth and gills as the current of water passes through. The cestode larvae noted above are the only forms which by any possibility could have any connection with food matter taken in fresh water. Consequently the purely trivial increase is strong confirmatory evidence of the fact that the Alaska salmon does not feed during its fresh water existence. In this respect then the Alaska salmon manifests an evident biological similarity to that of the Rhine. In other respects there is manifested a distinct biological contrast. In the Alaska salmon the parasites are reduced little if any in number during migration and the percentage of infection is exceedingly variable in specimens taken under all the varied conditions. Furthermore, one may maintain positively that at the close of the migratory period after a long stay in fresh water the parasitic fauna of the

Alaska salmon is still varied in character and still to be found in all regions of the body.

Evidently the results of this study stand in sharp contrast with those obtained by Zschokke and outlined above. They are thus both entirely unexpected and difficult to explain. Since they were secured by the examination of a single series of salmon they must be verified by careful work on the same host in other localities before they can be finally accepted. However, there is another fact which should be borne in mind. The Alaska salmon not only belongs to an entirely different genus from the European but it also has a radically different life history in that it perishes after the reproductive elements are discharged and never returns to the ocean to start upon another physiological cycle. Consequently this prominent physiological factor stands in radical contrast with the repeated migrations of the Atlantic species and one might reasonably expect to find other radical differences in the biology of the two species.

It is interesting to note that this limitation of life with a simple reproductive period coupled with the failure of the salmon to return to the sea is of considerable influence on the biology of the parasites it shelters. As we have already seen, the salmon carries large numbers of parasites into fresh water and since it does not return they must be left there. Among these forms are both adults and larvae. The parasitic life of the fresh water inhabitant does not seem to acquire any effective addition from the parasites which are introduced in this way since the examination on many hosts both in and about the lakes and streams failed to disclose the salmon parasites in any phase of their life history. To be sure some of the encysted forms may easily reach maturity in the birds or mammals which feed upon the migrating salmon; yet not only are such instances exceptional but they also present conditions which make it difficult to conjecture the means by which the adult salmon could be reinfected. It is evident also that the mature parasites of the migrating salmon discharge their ova into an environment where conditions for further development are hardly present. Even if the embryos should complete successfully the first stages in their life history they have no chance to reach the adult salmon which is their final host. A single distome which occurs in the trout of the

streams and lakes as well as in the adult salmon may owe its introduction into fresh water to the migrating fish for it would be difficult to conceive that its presence in the adult salmon dated from the time at which the young fish were feeding in fresh water before they went out to sea. In any event this instance is unique. The introduction of the parasite is unquestionably of long standing and it may be possible to explain the case on entirely different grounds.

It is evident then that the vast majority of parasites which the migratory salmon brings into fresh water streams and lakes in Alaska can find no further possibilities of existence. They perish without completing their life cycles or effectively propagating their kind. This large number of individuals which are thus of no avail in the perpetuation of the species forms a part of the reproductive surplus which is prominently discernable in all parasitic organisms. At the same time the removal of these parasites from the range of the growing salmon tends to reduce the degree of parasitic infection and to keep this host with the relatively low percentage of parasites which characterizes it in comparison with other marine fish.

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DISCUSSION.

Dr. Barton W. Evermann: I would like to ask Prof. Ward one question: Whether his studies of the parasites of the Pacific coast salmon show that those parasites are of fresh water relationships or salt water relationships, and if the answer to that

question throws any light upon the probable origin of the salmon whether of fresh or salt water origin.

Prof. Ward: Dr. Evermann's question is one of extreme importance and one reason why I omitted mention of it in the paper was that I did not want to have to give an opinion on it. The total inventory of this fauna is so extensive that I am not quite sure about the fact but the conspicuous species are of salt water character. I have not yet carried to ultimate identification all of the forms. The amount of material is rather large and the amount of work associated with its exact comparative determination also great.

I think that this may be said: I did find in salt water fish in the estuary, some of the same parasites; but I did not find in fresh water fish in the lakes, any of the same parasites with the possible exception of that one little distome which I mentioned.

Mr. Charles G. Atkins: It might be of interest to mention here some of our observations on the habits of the Atlantic salmon in American rivers. We have been at work cultivating them in the Penobscot river for many years. During some of the early years, at the request of the original commissioner, we made some observations on their food. I had the market men in the town of Bucksport save for us the stomachs of the salmon they were cutting up, and I sent about one hundred of them to Washington, and the experts reported that in the whole hundred they found nothing which could be called food. Those fish were bound for the spawning ground at that time. Every year from that time we have confined some hundreds of these fish captured in May and June, alive in a small enclosure till late in October in a fresh water stream, but never offered them food. Occasionally, if any of them died, we would examine their stomachs and see in what condition they were, and they did not seem to be capable of taking any food at that time. The stomachs would be much contracted; the walls very thick and solid, so that it seemed impossible for them to swallow food and manipulate it as usual in the stomach.

Dr. P. P. C. Hoek, Holland: In regard to the comparison of the parasites of the Rhine and Pacific coast salmon, the discussion is very interesting; but there remains a little point that

I hoped to have considered. There is another group of parasites than those mentioned, and we made observations on them. They are really ectoparasites; they are found on the skin of small trout, and found also on the small salmon during the first year of its life. The Rhine salmon does exactly as young trout does, and in that time it is infected just as young trout are, and with the very same species of parasites. I think it is curious that large salmon returning to the sea after having spawned, are infected with that same form. They are not very numerous but from time to time we catch in the mouth of the river salmon returning from the Rhine and going to the sea. Now with your permission I should like to ask Prof. Ward whether he has any information as to the Pacific salmon being thus infected also, and I thank him beforehand for his kindness in giving me that information.

Prof. Ward: That is a very interesting question. It can be answered easily, but it brings up a larger question. There is no similarity in parasite fauna between the Pacific coast salmon and the Rhine salmon; and when we compare the Pacific salmon with the Maine salmon we find more similarity between the Pacific and Maine salmon than we do between the Maine salmon and the Rhine salmon. I presume all ichthyologists would put the Maine salmon and the Rhine salmon very close together, but they would not put the Maine salmon and the Pacific salmon very close together. A year ago I had the privilege, through the courtesy of the Bureau of Fisheries, of studying some salmon in Maine, and the parasitic fauna of even the land-locked salmon from Sebago Lake was more similar to the parasitic fauna of the Pacific salmon than to the parasitic fauna of the Rhine or Elb salmon from the other side of the ocean.

President: While we are on this subject of the salmon, and because of the fact that there may not be another opportunity to bring up the matter again, I should like to call on Mr. Meehan for a statement of what he hopes to accomplish in the way of acclimatizing the Atlantic salmon in a river so far south as the Delaware.

Mr. W. E. Meehan: Mr. Chairman, the establishment of the Atlantic salmon in the Delaware river is somewhat a pet

topic with me. The stream is presumed to be below the latitude in which the Atlantic salmon is supposed to be naturally found.

As far as I have been able to find out by looking back at the records, no true salmon were ever found in the Delaware river in early days. But there were so many features about the river indicating that it ought to be at least a good brood stream and attempts were made in that direction.

The first efforts made to establish Atlantic salmon in the Delaware river were about 1870, when Thaddeus Norris and some others procured a lot of eggs and hatched them and planted them in tributaries of the Delaware river near Easton. One of the streams in which they were planted was known as the Bush-Kill, which emptied into the Delaware at the mouth of the Lehigh. Four years after, a number of salmon came into the Delaware river, and five or six were caught in nets. A few were found trying to make their way into the Bush-Kill at Easton.

A second trial was made and with the same results, but as there were only about half a dozen fish or so caught or seen, the experiment was considered a failure.

Nothing was done then for a number of years, but in 1890 the late Henry C. Ford, then president of the Fish Commission, and myself, made a very close examination of the Delaware river, particularly the upper waters, and knowing of the experiments of Thaddeus Norris, felt convinced that there was a reasonable chance of establishing fish in the stream. We secured a lot of eggs (I think the first lot of eggs was 60,000) from the United States Bureau of Fisheries. They were hatched at our station at Allentown and planted in the streams of Wayne county. The following year we secured about 200,000 eggs and they were planted in the same waters, and also in the stream called Blooming Grove, belonging to what is now known as the Blooming Grove Hunting and Fishing Club. In a very few months the fish showed up in large quantities in these various streams. There were so many, in fact, in the Blooming Grove that the club stopped all trout fishing in that stream, because they caught more of the little salmon than they did trout. They were seen shortly afterwards in the river. In 1894 there was a little run of salmon in Delaware river. In 1895 there was caught \$5,000 worth of salmon in the Delaware,—fish that were put in the

market freely, found in every restaurant of any size in Philadelphia, and the price before the season was over, went down from 50 cents to 25 cents a pound. They were caught in every shore net and several gill nets took salmon weighing from eight to twelve pounds.

Shortly afterwards Mr. Ford died and the Fish Commission, when they got the eggs and young fish, insisted on planting them to suit particular localities, some in the Susquehanna, and some in the Delaware near Easton, the statement being made by the then commissioners, "If Mr. Norris thought it good enough for Easton it is good enough for us"; and the result was inconsiderable. But salmon have been caught year after year since then up to this last year. Last year, as far as I have been able to find out, no salmon was caught; but last year a dead spent salmon was found—a fish weighing about twenty-four pounds—at the mouth of the Bush-Kill at the line between Pike and Monroe counties.

Hence, it is very evident to me that if from a planting of one year of 60,000 and another year of about 230,000, such a number of salmon should come back into the river, there is no reason why we should not believe and feel that it is possible to make a salmon river out of the Delaware by persistent stocking. I believe, of course, that the best fish to go in there is the Atlantic salmon.

The great difficulty we have met with is to secure eggs. There seems to be some law which prohibits the exporting of eggs from the Dominion of Canada into the United States, and the trouble I have met with therefore, up to the present time, is in the securing of eggs.

I believe that the only way to make a salmon river out of the Delaware is by hatching and planting large quantities of young fish in the tributaries of the streams such as these clear cold streams abundant in Wayne county, emptying into the Delaware.

We made experiments with the quinnat and it was a dead failure. We planted them in the tributaries, the same streams in which we planted the Atlantic salmon, and not a single fish was seen after they left the streams. They were seen in the little streams during the summer months but that ended them.

We made some efforts to domesticate the Atlantic salmon but

met with failure. I have half a dozen fish which reached spawning size out of four thousand. I think Mr. Atkins can say something about his efforts to domesticate the Atlantic salmon. I think they were not much more successful than mine.

Last year after a talk with Dr. Smith and Mr. Bowers of the Bureau of Fisheries, we made a trial with the silversides, it being a fish that spawned presumably about the same latitude as the Atlantic salmon. We received some 90,000 or 100,000 eggs, and from the eggs we hatched the fish at our Wayne station, planted a large percentage of them in the streams, and they are at present doing as well as could be expected in those streams with the low condition of the water due to the drought. We have saved a number of the silverside salmon in the endeavor to domesticate them, and I have here a bottle containing a specimen of the silverside salmon which we have reared and which were hatched this season. These fish are but a few months old. (Specimen exhibited.)

They feed as well as the brook trout and there seems to be no reason why we should not now raise those fish to mature size. Whether or not we can succeed in establishing them in the Delaware is another question, but I have hopes from the character and size of the fish which we are now rearing that we may be able to do so.

Mr. Charles G. Atkins: As Mr. Meehan suggests, we have at the Craig Brook station tried the experiment several times of domesticating the Atlantic salmon, that is, domesticating them to fresh water, and we have each time succeeded in getting them up to the spawning age and getting eggs from them, but they did not grow full size. Instead of growing to ten or fifteen pounds in size they were only three and four—the largest of them—and not apparently in very good condition; and the eggs that we obtained from them and the young hatched from them were of inferior quality. It is quite possible that the inferior quality may have been owing to faulty feeding. Perhaps we fed them on the wrong material, and if we had had the best material to feed them on, such as live insects or fishes, or something of that sort, it is quite possible we might have produced good eggs and good offspring from those salmon, but as it was it was not satisfactory, and there did not seem to be any object

in continuing the experiments, because if we did domesticate them and accustom them to fresh water, they would be no better than the land-locked salmon, which are already by nature accustomed to fresh water, and so we discontinued further experiments.

Mr. B. O. Webster, Bellefonte, Pa.; An Atlantic salmon which we now hold in Bellefonte has grown to be fourteen or fifteen inches in length.

Mr. W. T. Thompson, Leadville, Colo.: A point was brought out along the line of the Pacific coast salmon which was rather the subject of Mr. Ward's paper, but we did not get all the information that might be given on that subject. I think the Bureau of Fisheries must be able to furnish a little more about the success or non-success of the efforts to introduce the Pacific coast salmon into the Atlantic waters. Some of us are not well posted on the results, and if we could induce the commissioner or Mr. Titcomb, or some one to give us a little information, I think it would be appreciated by all.

President: Will Mr. Titcomb respond to Mr. Thompson's inquiry with regard to the success of efforts to introduce Pacific salmon on the Atlantic coast?

Mr. Titcomb: I have no statistics, but my impression is that 5,000,000 of salmon fry were planted in the tributaries along the Atlantic coast from Maine south to the Connecticut river, and possibly a little further south. They totally disappeared. Since then we have been trying the silver salmon and the humpbacked salmon in the rivers of Maine. It seems that the habits of these fish are more likely to be suitable to meet the requirements of these shorter rivers along the coast of Maine, and we have some hopes of success. They were planted in quite large numbers; some as fry, some as fingerlings three or four inches in length. They are both very hardy fish and easily reared to that size, but I cannot report any results as yet. I can report favorable results from the introduction of the chinook salmon (*Oncorhyncus Tschawytscha*) in fresh water lakes. In New Hampshire lakes they have been caught weighing nine or ten pounds, and have attracted the attention of the anglers. We do

not know yet whether they will reproduce when they have become wonted to the fresh waters or whether they will have the same habits of the salmon of the Pacific coast and die after spawning. But in two or three lakes in New England this salmon has been introduced successfully, so that it has been caught by the angler up to the size of nine or ten pounds, and proved a very gamey fish.

I do not dislike to discourage Mr. Meehan in his efforts, but today the bureau is maintaining a commercial fishery for the Atlantic salmon on the Penobscot river purely by artificial propagation. If that river were left to its own resources and the natural productiveness of the salmon, I think they would disappear in a very few years. We find it difficult to get enough eggs to keep up our stock; and Mr. Meehan has stated the difficulty of getting enough eggs to stock the Delaware. There is no place in the United States where we can get them, and if we could feel encouraged and have the courage that he has about the artificial propagation of salmon we would naturally try to stock the rivers farther north which are naturally better suited to them, and were once their natural habitat, like the Connecticut, the Kennebec in Maine, and the Merrimac which were once teeming with salmon, but now are almost depleted, if not entirely so, due to the pollution of the waters and the artificial obstructions which naturally come with the progress of civilization.

Mr. Meehan: Perhaps my courage may be due to the fact that I feel that today there are not many streams in which commercial fishing is done that could be maintained without artificial propagation; and if it were not for that there would not be anything of any kind in the waters. But I do believe that if we succeed in putting salmon in the Delaware, artificial propagation would have to be continued, and continued on a large scale at all times, and never stopped. In fact, we do not dare stop at that in any kind of work, for whether it be whitefish, herring or trout, or whatever the fish may be, it is artificial work today that is keeping the streams up.

Mr. Frank N. Clark: Why is not that the proper way anyhow? (Applause.) Take your eggs, hatch your fish, plant them in the water, and take your old fish out, just the same as you do with beef cattle on the farm.

Mr. A. H. Dinsmore, Birdsview, Wash.: I would like to ask why fish could not be purchased from commercial fishermen, as Mr. Atkins does, and retained there as he retains his fish, and then why the product from those fish might not be used?

Mr. Meehan: We might possibly do that.

President: Is there any evidence whatever here that the mature Atlantic salmon which has been induced to run in the Delaware, has ever spawned?

Mr. Meehan: The only evidence I have had in that respect is that last year a dead spent fish was found floating in the river at the mouth of the Bush-Kill at the border line of Pike and Monroe counties—a large fish weighing twenty to twenty-four pounds.

Mr. Titecomb: Male or female?

Mr. Meehan: Female, of course. (Great laughter.)

Mr. Titecomb: Not necessarily.

Mr. Meehan: In Pennsylvania when we speak of a spent fish we always mean a female. (Laughter.) I imagined that it was so generally.

Mr. Titecomb: When you are older you will feel differently.

Mr. Meehan: Possibly, but there were seen also in the Bush-Kill large fish attempting to clamber the falls at Reseca—evidently trying to get up into the pools above. That was three years ago.

QUESTION BOX.

Mr. Fearing: Has anyone had any personal experience in stocking waters with striped bass?

President: Mr. Fearing's inquiry has, I presume, particular reference to the depletion of the streams of southern New England and the middle Atlantic states, and he and others have been advocating extensive planting of striped bass fry with a view of restoring those waters.

Mr. S. G. Worth, Beaufort, N. C.: Mr. Chairman, a good many of us are familiar with the stocking of the waters of the

west coast of the United States with the striped bass, which has been pre-eminently successful. That was done with small members of the striped bass family, caught in the eastern waters by nets and otherwise, and shipped across the country. As far as I know that is the only stocking in those waters that has taken place. The cost of fry is a different thing to measure. The cost of the fry at the station on the Roanoke river, North Carolina, run by the United States government, has amounted for several years together now to something like \$300 per million. The cost has been that high for the reason that I have had too many fishermen on my payrolls and too many fishermen out of the river drawing salaries as spawn takers and not in fishing. It is my opinion that those striped bass eggs can be produced in North Carolina at a smaller cost than what I have given. For many years the cost of shad fry from the hatcheries of the United States was about \$70 to \$75 per million. I do not know how it is of late, but the using of fry for stocking purposes is certainly a practical thing today. Fry are easily moved, easily put in small ponds, keep well and grow fast.

Mr. John W. Titecomb, Washington, D. C.: The striped bass problem seems to be a good deal like the Atlantic salmon problem on our coast. It seems to me that the fishery all along the coast is going down every year. As I understand it, these streams in which Mr. Fearing is interested, are already natural streams for striped bass, and inhabited by them, so that it is merely a question of introducing a small number, as when the striped bass were carried to the Pacific coast. It appears that there is no hope for the striped bass on the Atlantic coast in the future unless we can have uniform state regulation, or what would naturally follow that, federal control, which will regulate the fishing for the striped bass in the bays where the water is salt or brackish, and where the fish are taken in large numbers before they can leave the spawning bed. It is the same problem which we are facing now in the preservation of the shad, which have disappeared practically from the rivers of the north, and are gradually disappearing from the Delaware where Mr. Meehan wants to introduce the salmon, and in the other rivers further south, and where we have only one instance of improvement, that is, in Albemarle Sound, where the state has adopted regu-

lations which seem to tend towards preservation.

We cannot today get the spawn of the striped bass in sufficient amount to promise any young fish for the northern streams, and there is no fishery on these northern streams of sufficient importance to warrant us attempting to secure spawn there.

President: Referring to the inception of the striped bass culture on the Pacific coast, is it not a fact that more eggs can be obtained there than at any point on the Atlantic coast, so far as our information goes?

Mr. Titcomb: I could have said so last year but not this year. Mr. Lambson, can you tell how many eggs we got this year?

Mr. G. H. Lambson, Baird, Cal.: About two and one-half million.

President: How many last year?

Mr. Lambson: I don't know. Mr. Titcomb has the statistics for last year, but I think it was about 7,000,000.

Mr. Titcomb: It was very encouraging last year for the first year's attempt; but that is where the striped bass is more abundant today than in any other waters of the United States, and we made very persistent efforts this year to secure eggs, not only through the bureau under the direction of Mr. Lambson, who is able to take care of over 100,000,000 salmon eggs every year, but also under the direction of Mr. Vogelsang, the deputy fish commissioner of the state of California. It is very difficult to get ripe females and at the same time ripe males.

Mr. Frank N. Clark, Northville, Mich.: Has there ever been any attempt made to pen them—to hold the males or females, or both until they have ripened?

Mr. Titcomb: Mr. Worth has had some experience in that direction.

Mr. S. G. Worth, Beaufort, N. C.: We find it impracticable to do it. The high temperature of the water at that time, about seventy-three degrees renders it impracticable. We do not succeed at all.

Mr. Clark: For what reason? Did the females plug and fail to ripen? Did they die or what?

Mr. Worth: They seemed to become covered with fungus rapidly, and to become sick and weak, and turn white around the fins; and it was no use—we tried it three or four times.

Mr. Titcomb: How large were the pens, Mr. Worth?

Mr. Worth: We had pens made of large, soft netting and held off with stakes and strips at the bottom, so that they were about six feet square. We did not make any experiments in long runways of water, like races.

Mr. Clark: Nor ponds built in the natural stream?

Mr. Worth: No, we made an honest effort to do that but got no results.

Mr. Clark: You made no effort to hold the fish except by penning them in these six-foot square pens?

Mr. Worth: That is true.

Mr. Clark: You did not have longer pens—sixteen or more feet?

Mr. Worth: We did not.

Mr. Clark: And you did not build pens right in the river and allow the fish to have free access to the bottom, whatever it might be.

Mr. Worth: We did not. Our pens were not as thoroughly and successfully arranged as they ought to have been, considering the importance of the subject, but in all that we attempted we failed.

Mr. Titcomb: In speaking of the penning, I have always been in hopes that we could put a rack at some point near Weldon on the Roanoke river, where Mr. Worth is operating, similar to those used on the Pacific coast. The objection to that is probably the fact that the people on the river above, would oppose it very strenuously, but I have a theory that if we could hold the striped bass in the river at some point we might get

together a large enough number to warrant continuing their propagation. Just at present the bureau is considering the advisability of the entire abandonment of the propagation of the striped bass at Weldon. I think we may continue another year on the Pacific coast in hopes that we may do better work there. When you speak of the output of eggs, I would say that Mr. Lambson reported two and a half million which he hatched. He took seven, eight or nine million, but the rest were poor eggs. That number is a mere bagatelle. One female bass will give you as many as 2,000,000 eggs sometimes. So when you report having taken after a season's efforts 15,000,000 eggs of the striped bass, it is nothing at all; it represents only half a dozen fish out of the whole river for a whole season's efforts. The rest have spawned the natural way.

Mr. Clark: I do not wish to rise here in the way of criticism at all, but I would advise this: If the bureau wishes to push striped bass work when they get the female bass when it is not ready and the male is, let all efforts be bent on that penning. In the first place you get a quantity of fish—

Mr. Clark: Oh, you don't—I thought you did. (Laughter.) You have got to get fish, of course; but when Mr. Chase first commenced penning whitefish on the Detroit river twenty-five or thirty years ago, I said at first, you cannot do it, but he did, but not with very good results till later on; but at first they met with the same difficulty until they got to building the crates right; got them in proper place and the fish got the proper amount of water. Even now we drive in stakes and build a little pen in the river and let the fish have the natural water. I should want to try all those plans for penning the fish. If you get fish that are not ripe, hold them and try all sorts of ways; because if you can get twenty-five or fifty fish and get them in ripe condition, you will have a lot of eggs; and I should not want to give the experiment up until I had used every effort on the question of penning. We tried the shad until every one was satisfied that we could not pen them, but there were not merely hundreds of dollars spent on the penning proposition with regard to the shad, but thousands and thousands of dollars and I helped spend it, and it was a failure.

Mr. Titcomb: Mr. Worth has explained pretty fully about the methods of catching the fish down there. They are caught by people as much for sport as a commercial industry. These men go out in boats at night with bow nets and dip nets; go along the bottom and scoop up the fish. Mr. Worth, in his efforts to get males and females together, has established seven telephone stations and if he catches a female at one station and another station has a male he tries to bring them together by telephone. (Great laughter and applause.) It is not a question of penning a lot of fish.

Mr. Worth: The boatmen have co-operated with us in this matter, but before we had telephones we lost some eggs. There have never been any seasons in the last five or six years but what we could have got twenty, thirty or forty, but we never got more than fourteen. The first fish was taken there about five years ago. It was a twenty pound striped bass from which we got over 2,000,000 eggs on the basis of 35,000 to a quart. Those are accurate figures and of course it does not take many fish to make an enormous output.

Mr. Titcomb: I don't know but what I ought to revert to that salmon question for a minute. When I stated that on the Penobscot river, the maintenance of a commercial fishery is entirely dependent upon artificial propagation, I referred to a condition which does not exist, as I understand it, anywhere else in the country. We propagate fish all over the country, but we also rely on natural reproduction. In many instances a mere brood stock of a certain species of fish put into a lake is all that is necessary; nature takes its course and the lake becomes well stocked, but if we should discontinue this artificial propagation on the Penobscot river the commercial fishery for salmon would become extinct in a few years, because we have very little evidence, if any, at present, that any of these salmon reach the spawning ground. Now our method of obtaining eggs there is by the purchase of salmon from the commercial fishermen. These salmon are caught in weirs as they ascend the river in June or July. This year we pay in the neighborhood of \$3.75 for every salmon we buy, both male and female. It is an expensive proposition, and the cost of operating a hatchery

for the maintenance of the salmon on the Penobscot river is almost equal to the returns from the commercial fishery. I do not speak for the Bureau of Fisheries, but personally it is almost a matter of sentiment whether we should maintain that hatchery or not, because of the conditions today—the returns are so discouraging in proportion to the outlay.

LIFE HISTORY OF THE COMMON EEL

BY DR. THEODORE GILL, OF THE SMITHSONIAN INSTITUTION,
WASHINGTON, D. C.

Dr. Gill: Mr. President and gentlemen of the society: I am quite unprepared to speak now as I had no expectation of being called upon, but I will make a few remarks.

As you are all aware, the eel has never been found with developed ovaries or spermares, in fresh water. The absence of such organs, so conspicuous in most fishes, has led to some remarkable conjectures and hypotheses respecting the nature of the generation of eels.

One of the most persistent of those hypotheses is that they were generated from mud, from putrefaction. That has been maintained from early times and has been persisted in by educated men as recently as two centuries ago. Sir Thomas Browne was one of the first to cast a doubt upon the allegation that eels were generated from mud. In contradiction Augustus Brown, a writer of the same period, treated the allegation as being axiomatic. In other words, he said, speaking of the generation of mice from Egyptian mud, upon which Sir Thomas Browne had cast a doubt, that it was as true and could be relied on as certainly as, among other things, the generation of the eel from mud. Of course, such a belief has long since ceased among educated people, but still persists among many of the uneducated. It has taken a long time to come to the truth; in fact the true conclusion has been reached only within the last two years. (The finishing touches, indeed, have not yet been made, and probably will not be made for a long while.) I wish now to refer especially to the late discoveries of Johannas Schmidt and Dr. Gemsöe.

It is still believed by many persons, as you are all aware, that eels do breed in fresh water; that they must breed there because eels are found in places that are apparently inaccessible; but of course all such ideas must be discarded at once, as there is no basis for the belief that eels, under any circumstances, ever

breed in fresh water, or anywhere near fresh water. It is hard to persuade some men that such is the case, but nevertheless it is a fact.

Now the eels not only do not breed in fresh water, but they go a long distance out to sea before they are able to breed. Up to the time that they are found in the estuaries and the fresh water of rivers, they still are destitute of developed ovaries and spermaries, unless examined with a microscope when these organs may be seen in a rudimentary condition.

The eels then go out to sea, so far as regards the northern European species, going out into the Atlantic Ocean, into water of the depth of at least a thousand meters; that is, over 500 fathoms to put it in round numbers, and it is only under such conditions that they can breed. Meanwhile as they are advancing into these depths doubtless the ovaries and spermaries become developed, and the eggs must be deposited in the depths. But they are floating eggs, having oil globules they ascend towards the surface. They are at last hatched and in the later months of summer or fall, young eels are found perhaps hundreds of miles from the coast on the high seas as leptocephali. Now it must take some months to pass through the condition from the time that the mother eel leaves the estuaries until the time when those eggs are developed and the young leptocephali appear at the surface or near the surface.

These young then come out in the form of leptocephali, entirely unlike the mother eel, being very transparent, ribbon like, very high and very much compressed, so unlike the mother eel that some ichthyologists long considered the leptocephali, which are merely the young of the various eels, as being a distinct order of fishes. For many years one species from northern Europe was known as the *leptocephalus morrisi*. That form was long the only one known, and that is nothing but the young of the conger. It is only within a few years that two eminent Italian naturalists discovered the true nature of the *leptocephalus* form of eel and connected by graduation this *leptocephalus* form with the eel. It was a species that had been only known before as found in the Mediterranean. Now it was believed, by some at least, that the common eel was generated in the same way as the conger, that is, by means of a *leptocephalus*; but this

was doubted on account of the supposed absence in the North Sea of any other specimen than the *leptocephalus morissi*. At last, however, the *leptocephalus* of the eel was found in great abundance by two special expeditions sent out by the Danish government under the naturalist Johannas Schmidt. He found these *leptocephali* in great abundance in the ocean remote from land, and, as I said, in water of the depth of about a thousand meters. He traced them from that place until they approached pretty near to the land. Even when they get into the estuaries they are still translucent, and in that condition they are known in France as *civelle*, and they have different names in other places, and are regarded in fact as a delicacy. They are translucent then, but still they are not the same as the *leptocephalus* found in the high seas; they have already assumed the sub-cylindrical form.

That is the condition; I will not go into detail. But we have now the evidence of the development of the eel from the condition of the *leptocephalus* until it has arrived at a mature state. Now it must take about eight years to complete that life cycle, that is, from the egg to the adult form, and it is only when the eel has been six and one-half to eight and one-half years in fresh water that it goes down to the rivers. The eel can of course live in fresh water for many years, but while there it does not develop its generative apparatus, the ovaries or spermares. The full details of this I will give in a paper which I will present later. (Great applause.)

DISCUSSION.

Mr. Charles G. Atkins, East Orland, Me.: I have had myself some opportunity to make observations on eels and their generation, which may be of interest. I should say about thirty years ago when engaged in capturing land-locked salmon at Grand Lake stream in Maine, we captured them by means of traps which took the fish descending from the lake trying to get into the stream; all the fish were taken moving down with the stream instead of upward. Occasionally we caught large eels, and I found them filled inside with an immense mass of what appeared to be white fat, but under the microscope it turned out that that white fat consisted of eggs, and while I do not

quite dare to say positively, yet I believe the number of eggs taken from each fish ran into the millions. I estimated them by weighing small quantities of the mass and counting the number of eggs in that mass. I do not remember ever coming across anything which appeared to be the generative organs of the males. So I suppose all I examined were females. They were very large and bound down the stream; and it is a common phenomenon of those rivers every fall to find great quantities of eels moving down the stream in a good many places. It has been the practice to capture them in large numbers and send them to market at that time, and I had supposed that this conclusion might be safely drawn, that the eels ascending into fresh water did mature their ovaries, and then at certain times moved down and went to sea, and laid their eggs; and that when the young reach a certain size, which may be three or four inches in length, they ascended the rivers. I have seen large numbers in rivers such as the Kennebec, three or four inches long, an immense mass of them, perhaps twelve to eighteen inches wide (I have noticed them as a boy) and so thick that one could hardly see the bottom through the mass. I have seen them moving steadily up the river right along the shore, and at Craig Brook where I have charge of the station now, we constantly find little eels all the way from three to eight or ten inches long, running up the stream; sometimes we catch a hundred of them in a night—little bits of fellows. We keep traps there set constantly, because we fear they are enemies of our young fish; we know they are when they are full grown, so we try to trap and reduce them in that way, and I supposed it was well established that it was their natural way to come up into fresh water, spend some years, get their growth, mature their reproductive organs, and then go down to sea to lay their eggs. My observations have been somewhat limited, but I feel sure that I found the eggs in those eels and reported the fact to Washington at the time.

Mr. C. H. Wilson, Glens Falls, N. Y.: I want to say that I

Note.—On referring to the original records it is found that one female eel contained three or four millions of eggs one one-hundred-twenty-fifth of an inch in diameter—the estimate being carefully made.

received a letter from Ex-Governor Smith of Vermont, who has a preserve in one of the provinces, stating to me that he spent six months making a study of the eel with a microscope, and that his conclusions were the same as those of Dr. Gill.

Mr. W. C. Thompson, Leadville, Colo.: Does the eel spawn more than once?

Dr. Gill: No, they die after spawning.

Mr. W. E. Meehan, Harrisburg, Pa.: Did I understand you to say that eels died after spawning?

Dr. Gill: Yes sir.

Mr. Meehan: That is not in accordance with out experience. In the spring of the year in the Delaware river and in the Susquehanna, there is a run of eels up the river of large size, that is, nearly as large as the run of eels down the river in the fall. The men take their nets which they use for catching eels and will get about as many then as they do in the fall of the year.

Mr. Atkins: It might be interesting to state some further observations I have made on the ascent of the young eels, and it appears to me that they are the most able climbers of all the fishes I have ever known. I have found them frequently at obstructed points in rivers. I remember of the town of Warren in Maine in the river there, I was examining the dam and the mills about it, and there was a large penstock leading to a saw-mill, and I walked alongside it, and the water was in the enclosure enclosed with wood—probably twelve feet high—I walked alongside it and the water was oozing out of the cracks near the top and oozing down the planks and boards, and numbers of young eels not more than four inches long, and probably not more than three, were creeping up that perpendicular wall and a great many of them were up higher than I could reach. So I consider them the ablest climbers that we have of all fishes, and it may easily be believed that all the eels in the fresh water came from the sea just as Dr. Gill has said.

Dr. Gill: I expected some dissenting remark, for I know the tendency of mankind to cling to old opinions, but I can assure you and Mr. Atkins that there must be some mistake in

this case, and if Mr. Atkins will only send to the Smithsonian Institution one of those eels we will give the solution of the problem. It is undoubtedly a case of fatty hypertrophy and degeneration of the glands.

Mr. Atkins: What glands?

Dr. Gill: Of the ovaries which are found in rudimentary condition, but also subject to hypertrophy and fatty degeneration, but you do not find the eggs fertile.

Mr. Atkins: I did not maintain that they were fertile.

Dr. Gill: As I said you can find the eggs in a rudimentary condition with the microscope, but those are not eggs that can be fertilized or which will generate young.

Then as for the other conflicting statement that eels do not die after fertilization, I do not know how the gentleman came to that conclusion, because eels are constantly going up and down the river, and why he should suppose that any particular eel he examined had ovaposed I do not know. At any rate it is regarded as certain that eels do die after oviposition.

The ovaries are developed to a great size. The conger eel in ordinary conditions has small ovaries but at maturity sometimes develops them to a bursting condition. Now the eel itself has to go to great depths to spawn, and no eel has yet been obtained from those depths. They undoubtedly will be later, and I am almost surprised that they have not been heretofore, but it is rather a difficult thing to get a large eel from the depth of 500 fathoms or more as you well know, and consequently none has been obtained as yet. But then we have the evidence of these leptocephali that have come to the surface. These leptocephali are found in all conditions; they advance slowly to the land. When they first enter the rivers they are still translucent, but by that time they have assumed the cylindrical form, towards which they have been gradually tending from the time they are found in the high seas hundreds of miles away until they approach the land. Now European ichthyologists, several of them, devoted long years of research to this subject; expeditions have been sent out at a cost of thousands of dollars. These investigators have been well equipped with intellectual and phy-

sical apparatus and have all arrived at the conclusion in question. I think we can rest assured that eels have never developed their organs in fresh water, and that they all die after oviposition.

One more word in proof. Allusion has been made by Mr. Atkins to the fact that eels ascend in numbers up the river. They do ascend in countless myriads. Go to the foot of Niagra at the proper season and you will find them by cartloads, by millions upon millions. Above that there is not one. Now under ordinary circumstances eels can ascend cataracts of considerable height, and therefore they may be found far, quite far from any river in which they have appeared, but when you find them, as has been done, in Lake Erie, it has been by virtue of the fact that they have been transplanted there. They will live there for a long while, for they are hardy and tenacious of life, but they will never propagate.

Mr. Atkins: I did not intend to say that I had observed that the eggs of the eels ever become mature, but only that I saw them in that rudimentary condition, large enough to be distinguished by the microscope, and in immense numbers. I suppose all the time that they went down to the sea so they would mature.

TULLIBEE (*ARGYROSOMUS TULLIBEE RICHARDSON*) AS A FISH OF ECONOMIC IMPORTANCE

BY GEORGE WAGNER.

(Presented by Dr. E. A. Birge of Madison, Wis.)

For several years the State Geological and Natural History Survey of Wisconsin has been engaged in a study of the fishes of the state. Perhaps the chief result of this study so far has been the recognition of the very general distribution of white-fishes of the genera *Coregonus* and *Argyrosomus* through the lakes of the state. The degree of variation among the forms found has proven to be very great, and much more collecting will be necessary before a complete report can be made. It is the intention here to discuss one species, certain peculiarities of its distribution, and their relation to the economic importance of the form.

The Tullibee, or Mongrel Whitefish (*Argyrosomus tullibee Richardson*) is a form chiefly known from Western British-America, although recorded from as far east as Lake Onondaga, New York. Occasional specimens have also been taken in all of the great lakes. As far as we know, this is the first notice of its occurrence in Wisconsin, or in any waters of the Mississippi drainage basin. So far we have found the form in three lakes of Wisconsin, which differ rather widely from one another in their physical characteristics. It is now well understood that the critical period for a lake, as far as its living organisms are concerned, occurs in August, at the full establishment of the thermocline. The conditions in these lakes at that time have been well studied by Professor Birge and Mr. Juday of this survey.

The lakes concerned are Kawaquesaga, at Minoequa in Oneida county; North Twin Lake at Hackley; and Long Lake, about four miles east of Hackley. Both of these last are in Vilas county, and all three drain into the Wisconsin river, although by very different routes.

The portion of Kawaquesaga where we took our specimens has been characterized in a recent paper (Trans. Wisconsin Academy of Sciences, Arts, and Letters. Vol. 16; p. 18). It is 12 to 18 meters in depth, of rather irregular outline, and an area of about 2.5 square kilometers. Its surface temperature in August is about 20 degrees C., while the bottom temperature is about 9 degrees C. As we descend the oxygen becomes gradually less until at about 10 or 11 meters it disappears entirely. It was only to corroborate a natural supposition that we fished below this depth and caught nothing. But when we set our nets at 8 to 10 meters, where oxygen still occurs, only in about one-tenth the amount found at the top, we caught Tullibee in abundance and of a weight up to three pounds. From here it ranges upward to within 3 or 4 meters of the surface; at the surface itself it does not seem to appear.

North Twin Lake at Hackley is of about the same depth as Kawaquesaga, but its area is much larger and more fully exposed to the wind. Hence while the surface temperature is about the same as in Kawaquesaga, the temperature at the bottom is higher, or about 11 degrees C. The decrease in oxygen is not quite so rapid either, and there is some left even at the bottom, or one-half m. above it, although only somewhat less than one per cent of what there is at the top. Yet here it is in the lowest meters of water that we caught Tullibee abundantly, and more were taken in shallow water.

Long Lake is of a different character from either of these lakes. It is long and narrow, curved enough so that the effect of the wind is at least partially checked, and of great depth, especially for its width; 26.5 meters were found near the northern third of its length. (It is to be noted that this is not one of the two lakes of the same name, referred to in March's Table of Lakes. Wis. Geol. and Nat. Hist. Survey, Bulletin No. XII; p. 88.) It is fed in largest part by springs and its narrowness from east to west and forested shores protect it somewhat from the warming effect of the sun; vegetation in it is rather scant, except at the lower end, which is shallow. Consequently the usual cause for the consumption of oxygen at the bottom is largely absent, and one-half as much oxygen occurs here as at the top. The bottom temperature is low, only about four or

five degrees C, while the top is nineteen degrees C. Here again we caught Tullibee in great numbers at the maximum depth, and none above, even after repeated efforts.

We have here then a species of whitefish, large enough and of good enough quality as food to be worthy of economic consideration; that seems to be able to adjust itself to quite various conditions of environment. Certainly its adaptability is very much greater than that of *Coregonus labradoricus*, which, so far as our experience goes, occurs only in the deep waters (in summer) of lakes approximating Long Lake in their physical characters. Of course, there is a limit to the adaptability of the Tullibee, as is shown by its restriction to certain depths in both Long Lake and North Twin Lake.

Nevertheless, the species seems to be a very promising form for introduction into certain large shallow lakes. In Lake Pepin on the Mississippi, Lake Winnebago, and some others, we have lakes that are comparatively shallow, and so large that their utilization for commercial fisheries, as well as for sport, is not only possible, but highly desirable. Lake Pepin is now being so utilized to a very large extent. But it yields only the coarser fish, such as buffalo, carp, and to a certain extent, spoonbills. The successful introduction of a whitefish into this lake, and a proper regulation of its capture, would prove a great and lasting benefit. Whitefish (*Coregonus clupeiformis* Mitchell) have indeed been planted in it, but with no success, the genus *Coregonus* being seemingly not adaptable to such waters. But it seems to us highly probable that with so adaptable a form as the Tullibee, and with heavy and persevering planting through four or five years, success could be attained. And there are other lakes in Wisconsin, and probably elsewhere, where it could be introduced and its fishing permitted under certain restrictions, without any detriment whatever to the game fishes.

DISCUSSION.

Dr. Frank N. Clark, Northville, Mich.: I think the recommendation is that the tullibee be planted in these lakes where true whitefish will not succeed.

Dr. Birge: Yes, where there is at least a chance of that.

Q. Has there been any experiment tried in the line of taking the eggs from them?

A. So far as I know there has not. This was a matter discovered only last summer and there has been no opportunity for us to do anything. But it seemed worth while to make the suggestion so that if there was opportunity something might be done.

Q. Then it is not known in just what form the egg may be, but probably something like the herring egg.

Dr. Birge: We shall try if possible to have our fish commission get some eggs next fall. Our species in the inland lakes spawn in the late fall and I would expect the tullibee would spawn much about the same time.

Mr. S. G. Worth, Beaufort, N. C.: I would like to ask in what manner the quantity of oxygen in the water at those different depths was determined.

Dr. Birge: I gave an account of that at the last meeting. The Wisconsin Geological and Natural History Survey has been making an extensive study of the distribution of oxygen in the Wisconsin lakes, and we have been aided by the United States Bureau of Fisheries in that work. We shall make some report on it at the later meetings. Perhaps it would be as well not to go into that at this hour, but the oxygen, temperature and other physical conditions in these lakes were examined carefully from the surface to the bottom, at frequent intervals, as close as one meter apart, wherever there was any essential change. Mr. Wagner was working with us, catching fish in the same lakes as those in which we were determining physical characteristics; and there is no question about the correlation, the work being done within the space of a few days.

EXPERIMENTS IN REARING SMALL-MOUTH BLACK BASS

BY ROBERT RIPPLE, IN CHARGE OF HATCHERY, MINOCQUA, WIS.

(Presented by E. A. Birge, Commissioner of Fisheries.)

The following paper records some experiments made at the Minocqua Hatchery, Wisconsin, with artificial nests for rearing small-mouthed black bass. These nests are made of Portland cement, mixed one part cement, two parts sand, moulded in a box twenty-four inches square, with rounded corners. They are about three inches thick at the edge and one inch thick in the center, where there is a hole one inch in diameter. They weigh about fifty pounds each. The surface is covered with gravel and stones, and sprinkled with sand. About fifteen to eighteen stones of various shapes and the size of hen's eggs are set near the center; outside of these come smaller stones, diminishing to fine gravel at the edge. Great care is exercised in setting the stones, so that the nest will appear natural and so that the nest will drain as well as possible to the central hole. When in use the hole is blocked by a small stone. This prevents loss of eggs in the hole and also makes the nest more acceptable to the fish. A loop of strong copper wire is embedded in each side of the nest, by which it can be easily handled.

The purpose of these nests is two-fold: 1. To render possible some experiments in hatching eggs on trays after removing from the nests. 2. To furnish better conditions for hatching than are given by the nests made by the fish themselves.

I will speak of the second point first. It is well known that no better conditions for hatching the fry can be supplied than are offered by a natural nest of the best type, on which the eggs are properly spread by the female and which is properly guarded and fanned by the male. But such conditions are by no means always met. The stones in the center of the nest may be too large, leaving deep and narrow crevices; and whether they are large or small the spaces may be such that the eggs which fall into them cannot be properly fanned. Such eggs are almost

certain to die and to be attacked by fungus. This condition is aggravated when, as often happens, the female does not properly



BLACK BASS NEST.

scatter her eggs but drops them in masses. In such case those eggs which fall between the stones are certain to become fun-

gused. Many failures of nests to develop fry, attributed to lack of fertilization, are really due to causes of the kind here indicated. The evils caused by imperfect circulation of the water are by no means ended when the eggs are hatched. Many of the young fry fall between the stones and are smothered or attacked by fungus.

These evils have caused annually the loss of many eggs and fry at the Minocqua Hatchery and I was, therefore, led to experiment with the artificial nests described. Some fifty nests were made last winter and were put to use this season. They were placed in the ponds so as to be sheltered by a stump or log and were sheltered by a two-sided frame of one-half inch boards, placed near the nest. The males hesitated at first to accept them but soon did so and altogether some seventy-five pair of bass used them in ponds where there were plenty of old style box, loose gravel nests. In many cases they preferred the new nests; a good many being used more than once. Many of our breeding bass come from lakes where they are accustomed to spawn on bars covered by large stones. Such fish will hunt for spawning beds like those to which they are accustomed; but if they are put into ponds with only sand or fine gravel on the bottom, they will come to the artificial nests and be content with them. They will also hatch out and raise a larger percentage of fry on the artificial nests than on one constructed by the fish out of large stones. Even though only smaller stones are given them, the circulation of water is better in the artificial nest than under natural conditions and the results are correspondingly better. Altogether some fifteen nests were hatched successfully under natural conditions on these cement nests and the results were such as to convince me that it would be well to provide them in all cases.

The immediate purpose of making the cement nests was, however, not so much to furnish the bass with better nests than he could build, but to make possible experiments on removing the eggs and hatching them on trays. When the eggs are first laid they adhere rather firmly to the stones, but after the third day they can easily be detached. The nest is taken from the pond to the hatching house and placed on a tub or similar vessel in the fry trough. The water is allowed to rise in the trough until it fills the tub, and, rising through the hole in the center of

the nest, fills it to the edge, or, at least, so as to cover the eggs. The eggs are then loosened with a feather, working them toward the center; the nest is then raised and lowered a few times and the eggs flow with the water through the hole in the nest into the tub. The whole operation may take a half hour on the first day; two or three days later it would occupy perhaps ten minutes. If the nest has been made with the proper drain and dish, the eggs are removed quickly without loss or injury. They are then placed in trays, which are put into an ordinary hatching trough. Only three trays are placed in each compartment, so that the eggs may have abundance of water; each tray carries about 3,000 eggs. The temperature of the water is 55° to 57° F.

After hatching, the fry remain on the trays until they are ready to feed—about ten or twelve days. They are then transferred to screens in the ponds to feed themselves until they are distributed. About 50,000 fry were raised in this way during the present season with very little loss.

I do not recommend that all eggs be taken from the nests and hatched in this way. The conditions offered by artificial hatching are as good, but not better than the best natural conditions. But every breeder of bass knows that there are many nests in his ponds, where part of the eggs and fry begin to become fungused from the causes indicated in this paper. If such nests are on natural bottom nothing can be done to save the eggs, since they cannot be removed from loose stones, gravel, and sand. But if all the fish spawn on these cement nests, those nests may be left in the care of the male which are in good condition and are properly cared for, and the others can be saved by removing the eggs. The best are not unlikely to be the nests containing the largest number of eggs, and there will probably be a considerable number of nests, so that the gain will be well worth the cost in time and trouble. Many smaller losses of eggs are also avoided by the use of these nests, since in the natural nests it almost always happens that some eggs or fry are deposited where they are not in the currents of water, and die in consequence. Some nests are also deserted by the male fish and are left without the natural protector.

It is intended next season to furnish these nests for all the

small-mouthed black bass in our ponds. A further report will be made if any new or interesting facts develop.

DISCUSSION.

Mr. W. E. Meehan, Harrisburg, Pa.: This paper represents the very latest development in small-mouth bass culture, as far as I know, and it is extremely interesting, and I have another matter in connection with it to which I wish to allude. We have here today a man who may perhaps share with one other man the title of father of the work of bass culture. If I mistake not, somewhere about 1880 a major in the army, I think Major Wright, built a pond, put bass in and hatched them and prepared a bulletin published by the United States Commission in 1881. Almost simultaneously Mr. Hiram Peoples of Pennsylvania, started bass culture near the city of Lancaster, and he is here today, and I think some might be interested in knowing of Mr. Peoples' early work in that line, which seems simultaneous with the work of Major Wright. Mr. Peoples was a member of the Pennsylvania legislature for several years while conducting this hatchery of bass commercially.

Mr. Hiram Peoples, New Providence, Pa.: I have been engaged in bass culture for a number of years, at first, merely as a matter of pleasure, and afterwards in a business way. In constructing my nests I take only good sized stones, none less than the size of a common marble up to the size of a walnut, and larger. I place these nests around my pond, not closer than fifteen feet apart, and in water say from eighteen inches to two feet deep; and I have always succeeded in raising all the bass I needed. In fact I have been able to supply all demands.

I have never taken the spawn right from the nest, but I have taken the small bass immediately after being hatched, and placed them in adjacent ponds, but never had any success. I always had to keep my bass until partly matured.

I never had any trouble with fungus or any disease in the ponds. I can drain my ponds in two days and put fresh water in, but I do not generally do that. I drain every spring and fall.

I ship my bass from the 15th of June till the 10th of August.

If there are any remaining then, I keep them until the fall and then ship them. I have never tried the artificial nests.

I was first led to make the nests as I do by watching the bass themselves. I was pretty fond of fishing, and I would bring fish from the river up and dump them into the pond, and I happened to walk around one day and saw these bass working at the nests; I saw the kind of nests they made and after that I imitated them. I place in a pond of a quarter of an acre, about thirty bass, and I am very careful in selecting them. If you have bass that spawn ten days later than the main lot you will eventually have no bass. Those ten days older will grow and eat all the rest. I remember in my pond I saw a splendid nest and I debated whether to encircle them immediately with fine netting or not; but I did not do it until the second day, and then there were no bass there. The great trouble in raising bass is to keep the small ones from eating one another. In one case I estimated there were 20,000 bass in a certain pond in the spring, which I did not drain until fall, when I had only 260. I put 400 at one time in a trough, and at the end of a month had only four or five left.

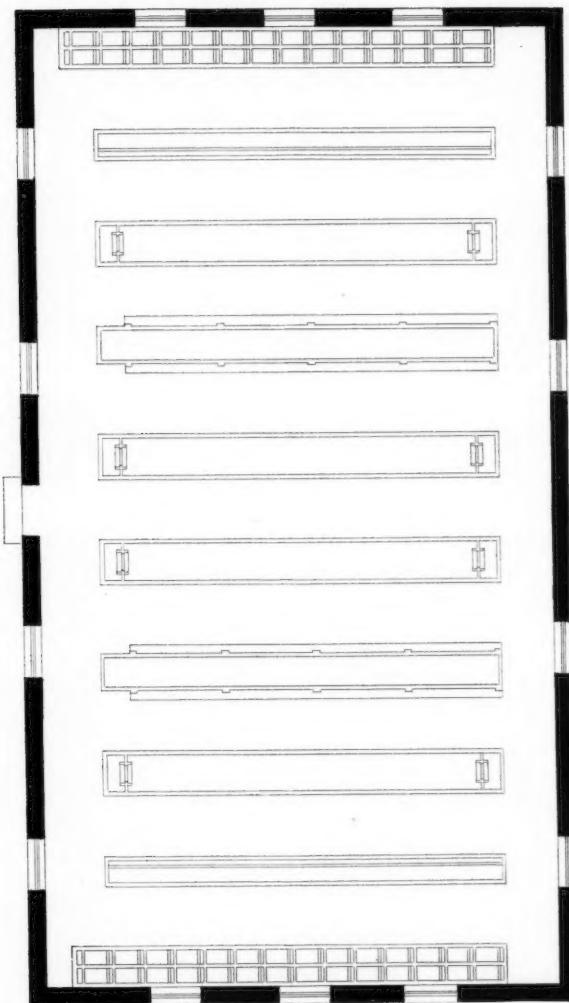
THE MODERN HATCHING HOUSE

BY S. F. FULLERTON, OF ST. PAUL, MINN.

We live in the *beginning* of the cement age; no, I will say that we are living *in* the cement age. They are building almost every kind of plant that can be built with wood, iron, stone or steel and using cement to do it. Today we see stately buildings, immense bridges, great elevators—all constructed of cement. But the purpose of this paper is to show what can be done with cement by the fish culturist. Various materials have been used, wood, perhaps to a greater extent than any other, tin, sheet iron and various compositions but none that gave entire satisfaction; sheet iron and tin for the reason of its elasticity not being stiff enough; wood for the reason that it was short lived and consequently expensive.

A year ago, as superintendent of fisheries for the state of Minnesota, I was confronted with a problem of replacing all the wooden buildings and troughs including our pike-perch battery at our St. Paul station. We had been patching until it was hard to tell where the original left off and the patchwork began. I had constructed some cement ponds four years ago and found they gave good satisfaction, standing the winters and summers, and consequently the contraction and expansion that would come with the heat and cold. I laid my plan before the board and got their approval to build a cement house 32x64, everything but the roof, doors and windows to be cement.

The place selected was a veritable swamp, twelve feet of muck and peat filled with springs. We made up our minds if a building could be constructed of cement on land of this description it would be a pretty good test of what could be done with conditions more favorable. We first laid 4x10 plank side by side lengthwise of the foundation walls, placing six inch cedar posts four feet long crosswise every four feet apart. We then walled up the sides and placed our concrete mixture, consisting of two parts of broken stone, three parts of clean, sharp sand and one part of Atlas Portland cement. This part of the wall



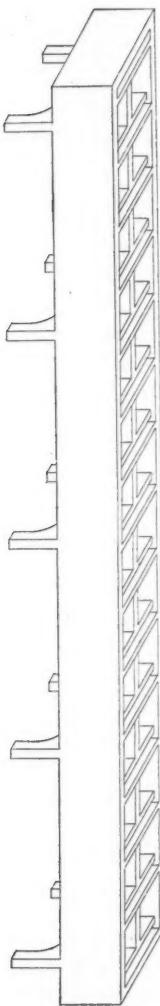
we built two feet high so that we had for a starter a foundation of 2x4 of concrete floating on this peat bog; then we jogged the wall six inches on each side and built another foot. Then the

wall proper was started, being twelve inches thick—that was built of the same mixture and in the same manner to the required height, setting our windows and door frames as we advanced. In the walls we built all pipe connections for our intake and waste water as all water used is gravity. The whole house has settled six and one-half inches and settled all together.

Now the problem of a floor on this bog was next to be tackled. We leveled the ground off fairly well and put a coating of railroad cinders to the thickness of ten inches, using the hose and two men tamping all the time so when the ten inches of cinders were all in we had a fairly hard surface. Then we laid all around the walls a row of three inch tile drain pipe connecting with a pipe already built in the wall. We then laid our waste pipes in the cinders and over the entire surface of the floor we laid ten inches apart 2-inch old gas pipe that we got for \$1.50 per hundred from Brother Israel who had picked them up as old iron. Then we put on concrete of the same mixture as the walls to the thickness of four inches. On top of this we put a 2-inch layer of clean, sharp sand, three parts to one of concrete, this finished our floor and not a sign of a crack is visible because it is all bound together and when one part settles the whole surface must go down together.

Now, to utilize this floor space to the best advantage we decided to construct our troughs and batteries across the narrow way of the building. On each end we constructed our frames for a Clark Williamson box for our trout. These we made double, each pocket 10x15x15 deep, fourteen compartments to each side, sixteen trays to each compartment, making a total for the two boxes of eight hundred and ninety-six trays. The walls we made three inches and the cross sections two inches. It took about 680 feet of lumber at \$14.00 M, to make the frame for this box. Of course, the sides and bottom can all be used over again, but the wood used in the inner walls must be cut out and is entire waste. We used twenty-two sacks of cement, and of course three times as much sand—about four loads, costing \$1.00 per load.

Four feet from this box we constructed our picking trough made to hold the trays as they were taken out and distributed. This picking trough I built with a four inch space for the dead eggs and a pocket on the end to receive them, as I intend to use



the water for a rearing pond at the back and don't want the dead eggs in there. Four feet from the picking trough I built a receiving tank for our pike-perch work, using half inch rods well

painted with ten inch end washers built into the wall of cement. This stiffens it and prevents either contraction when empty or expansion when full of water. Next to this I built our battery four tiers high with connections with the tanks all of cement, so the house holds two double Clark-Williamson boxes, two picking troughs, four receiving tanks and two batteries. In all the cement work I ran a No. 4 soft wire within two inches of top of wall and around the ends so as to have a continuous wire all around; also, in the Clark-Williamson boxes I ran a wire through the cross walls connection with the outer walls, binding the whole in one solid mass. The mixture for the boxes I made after experimenting out of clean, sharp sand three parts to one. I have experimented with six to one, five to one, four to one and two to one. I find the two to one too rich and liable to crack but the three to one in my estimation is the ideal mixture, but we must always be careful to have the cement and sand well mixed and if care is taken there is no question about the durability of the boxes.

All legs under the boxes are part of the boxes themselves and built from the floor up of cement. I scrape all frames on inside, which leaves the cement smooth when boards are removed. Then I thoroughly remove all fine cement dust, filling in any small dents; then give three coats of Elaterite water proof paint, being careful to see that each coat is thoroughly dry before the next is applied.

Now, I claim these troughs I have described are better than can be made from any other material for the reason that wood will decay and iron and steel rust, but cement will be better fifty years from now than it is when first made. It is always clean, never leaks, does not harbour any fungus growth and does not have to be replaced.

Now, as to the cost: The first cost is more than wood but with clear white pine selling at from \$38.00 to \$50.00 a thousand the difference is not so great, and is all in favor of the cement when the lasting qualities of the material are taken into account. This year we got our Atlas Portland cement for \$1.20 per barrel; the sand and gravel we had on our hatchery ground. We did all the work with our own crew, with the exception of two laborers; but I want to be fair and will suppose that every

bit of material including labor, has to be contracted for the first cost above wood is about fifty per cent. A great part of this is for the frames that must be made and as the most of them must be cut away, they, of course, become useless. Receiving tanks for fry and frames for the picking troughs, one can be used for making several. Also all frames for the legs can be used over by bolting them together and when cement is hard unscrew the bolts and they fall apart and can be re-used.

Now, I have written this paper for the purpose of drawing the attention of the members of this association to the use of cement in constructing troughs for hatching fish. I want you to ask questions and I shall answer them to the best of my ability. There is no question in my mind about the superior qualities of cement over all other materials, and I here make this prediction that inside of ten years no other material will be used by the fish culturist in the construction of buildings and troughs.

DISCUSSION.

Mr. Fullerton: I predict that inside of ten years all houses and all troughs in them will be constructed of cement.

Dr. J. A. Henshall, Montana: Do you reinforce any of the work?

Mr. Fullerton: Yes, with a No. 4 soft wire run through the wall and in the cross section. I just hook it in the long wire; I do the same with the receiving tank.

Mr. Frank N. Clark, Northville, Mich.: I would like to ask if this house has just been built?

Mr. Fullerton: No, it has been built two years.

Q. It has gone through one fall?

A. Yes.

Q. I understand your building is 32 by 64; 30 by 60 inside?

A. Yes.

Q. What is the capacity of your house?

A. We aim to put 2,000,000 trout eggs in the house. I have a pike-perch battery in there also.

Q. One battery?

A. Two.

Q. How are you going to take care of 50,000,000 lake trout eggs?

A. We do not hatch any lake trout at all. This house is designed for Minnesota.

Q. I understand each cross section is two inches?

A. Yes.

Q. That takes up a great deal of space?

A. Yes.

Q. How many trays do you have?

A. Over 800.

Q. Well, with a hatchery where you require large capacity you must build a much larger house?

A. Yes, or build two.

Q. Or three perhaps?

A. Yes.

Q. You state that your room is just about the size of our room at Northville, and our capacity now has been increased 4,000,000. We had 46,000,000, and it is practically 50,000,000 capacity now. You have just about the floor space that we have now, and it holds 50,000,000. Of course with your plan of cementing it could not be done.

Mr. Fullerton: Why?

Mr. Clark: There is not room enough in the house. Where you have 400 trays, we have about a thousand in the same floor space.

Mr. Fullerton: But you have got more boxes.

Mr. Clark: I say where you have 400 and odd we have over a thousand.

Mr. Fullerton: We could increase the number of our boxes.

Mr. Clark: No, you cannot, not with your cement.

Mr. Fullerton: Why?

Mr. Clark: Your cement takes up so much room.

Mr. Fullerton: Not a bit—only two inches more than yours does.

Mr. Clark: You have two inches each side.

Mr. Fullerton: No, one inch on each side more than yours.

Mr. Clark: The question is whether we cannot devise some means of making that cross section a great deal narrower—that is what I am getting at—instead of having it two inches, get it down to an inch by using wire for reinforcement so that we will not have such a bungling trough and it will give us more capacity. I am just getting ready to put in two new piggery troughs and with the approval of the Washington office I shall undertake to put in cement.

Mr. Fullerton: You will never regret it.

Mr. Clark: We have a cement floor in the house and can start with that to build upon.

I would like to ask why iron standards would not be just as good as cement. We have had iron pipes at Northville, without a particle of wood on the floor, for fourteen years; and it is a question in my mind whether the gas pipe as standards would not last about as long, keeping them properly painted—say five years. Ours at the end of fourteen years are just as good as new, and it seems to me it would be easier to have the iron standards than the cement standard as a support.

Mr. Fullerton: Perhaps iron would do. I do not see why it would not. I started out to make a cement trough throughout altogether, and we made the legs circular and four inches square on the floor.

Mr. C. G. Atkins, East Orland, Me.: How long after you completed these troughs was it before you put eggs or fish in them?

Mr. Fullerton: I do not know just how long—some months.

Q. Did you ever see any difficulty that appeared to come from the cement injuring the water in any way?

A. No, the paint would stop that anyway.

Mr. Atkins: I have heard some objection made on that ground.

Mr. Fullerton: I believe that soon we will all be using cement.

Mr. Clark: You can put water in in twenty-four hours.

Mr. Fullerton: Yes, in six hours.

Mr. W. H. Safford, Conneaut Lake, Pa.: How many rows of troughs have you in your perch battery?

A. Four, one above the other.

Q. And your jar standards—what provision have you made for those?

A. I am glad you mentioned that. We have here a continual shelf for the jars to set on, and through that shelf there is a pipe.

Mr. Safford: Did you give any estimate of about what the weight is for each trough and about how many troughs that floor would stand? For instance, at my hatchery in Crawford county the water supply is limited, and in order to get at a production that we think the hatchery is capable of putting out, we get our increase in the number of troughs. I have eight, one above another in my battery, and in that way it gives us 343 jars in one battery.

Q. That is, on both sides of the battery, is it?

Mr. Safford: Yes. Do you suppose that the first trough in your battery would hold up, say eight of those?

A. Yes, I think it would hold up twenty or thirty. These standards are all made of cement right from the floor.

Q. What are the dimensions of the standards?

A. Four by four. The shelves that the jars set on are cement, built into the standards; it is all one solid piece of cement.

Q. Do you make these troughs separately or build them all together?

A. We build them right in there.

President: This is a paper of unusual value and is broad enough to cover the general cement work.

Mr. Clark: I do not want to advertise myself nor the Clark-Williamson box—the only box I ever got up; but I will say for the benefit of the members here that the box known as the Clark

box was invented by my father in 1874. As Mr. Fullerton has told you, this is the Williamson box, and the Clark-Williamson box is really a combination of the Clark box and the Williamson. Now in the Clark-Williamson box (as I showed you with a model at White Sulphur Springs) is an opening where the water comes up through a two-inch water space and flows over on the trays. Now the Clark-Williamson box is simply widened out, and we use it for trays and it has a remarkably great capacity in comparison with the space occupied.

Now I would suggest, if you build trough that to save expense and economize space, you try a Clark-Williamson box.

John W. Titecomb, Washington, D. C.: All the parts of the equipment exhibited at the White Sulphur Springs meeting are on exhibition in our basement at the Bureau of Fisheries. We also have some salmon eggs hatching there. Part of this equipment is in the main exhibition room and labeled, and a part of it is out in the car shed, and there you can see the Clark box and the Clark-Williamson box illustrated.

Mr. Fullerton: One word about Mr. Clark's statement as to capacity: We can build these troughs two feet higher if we want to and increase the tray capacity.

Mr. W. T. Thompson, Leadville, Colo.: How many trays will yours hold?

Mr. Fullerton: Sixteen, one on top of another.

Mr. Clark: We are now building double deckers. I think the next one I build will be a three decker.

Mr. Fullerton: There is no limit to the number you can build and the cement is all right.

SOME EXPERIMENTS ON THE ARTIFICIAL EXPRESSION AND FERTILIZATION OF GOLD FISH

BY JERRY R. BERKHOUSE, SUPERINTENDENT OF THE PENNSYLVANIA STATE FISH HATCHERY, TORRESDALE, PHILADELPHIA.

The Department of Fisheries of the Commonwealth of Pennsylvania rears gold fish for the use of public schools, public institutions and public parks, but not for private applicants. At the hatchery under my charge at Torresdale, Philadelphia, I handle principally the common gold fish and to a limited extent, Japanese three tails. From autumn until early spring the adult gold fish of both types are kept in a large triangular pond and in the spring the three-tailed fish are removed to a smaller pond. The regular practice has been to have the gold fish of both types deposit their eggs on the roots of water hyacinth, the plants containing eggs being removed every morning to small ponds having no fish of any sort, and the eggs allowed to hatch naturally.

During the winter of 1907, my chief, Commissioner Meehan, directed that when the spawning period arrived I should make some experiments in the artificial expression and fertilization and hatching of gold fish eggs. This I did in the latter part of May and beginning of June, 1908, being perfectly successful in artificially taking the eggs and fertilizing them and succeeding in hatching more than 60 per cent. I used three females of the common gold fish and a like number of males. I pressed the eggs from the female and the milt from the male in precisely the same manner as from a brook trout. Both the eggs and the milt flowed with perfect freedom, just as freely in fact as eggs and milt from brook trout.

Before taking my first fish I dipped the pan in the water, but instead of draining it off as is usual in the dry method, I left a small quantity of water on the bottom, just enough to cover it but not enough to bury the eggs. After taking the eggs,

I pressed every particle of milt obtainable over them and it was a very large quantity, so much that the water in the pan was distinctly whitened. After fertilization the eggs were washed and allowed to harden, as I would do in a case of brook trout eggs, but in a few minutes they matted together in a thick mass even more compactly than the eggs of the wall-eyed pike would under the same circumstances. I separated them as well as I could in the same fashion as I would the eggs of the wall-eyed pike, but even then there were a number of nodules or balls of several eggs. I then transferred them to a hatching jar and turned on the water. Although the faucet was turned so slowly that the water merely dribbled through and carried air with it into the tubes, the current thus created was sufficient to cause many of the eggs to rise to the surface, and had it not been for a screen of cheese cloth across the lip would have escaped into the trough. The eggs also when they touched each other immediately clung into little balls. None of these eggs hatched. Practically all the eggs died.

The eggs from the second fish were taken by the dry method and after fertilization and the introduction of water, I added a small quantity of mud and worked the eggs in the same manner as wall-eyed pike eggs used to be worked under the same circumstances. After washing, having previously prepared a hatching trough by running about eight inches of water therein, I poured the eggs over a cheese cloth tray scattering them so that they scarcely touched each other. I allowed the tray to float on the surface covering the trough with a board so as to totally exclude the light.

The amount of water flowed through the trough was little more than dribbling. The stream was scarcely larger than a knitting needle. In five days with the water temperature at 50, about 60 per cent of the eggs hatched.

The eggs from the third fish were taken and handled in the same manner as the second, but instead of putting them on a tray, I allowed them to sink in a trough upon some fine gravel which I had placed there. The depth of water was the same as in the case of the eggs of the second fish, namely, eight inches. The eggs settled very slowly, so slowly in fact that at the end of half an hour those which were still not on the bottom I scooped

up and placed upon a cheese cloth tray allowing the tray to float on the surface as before. Every egg that sunk to the bottom died, while the hatch of the eggs on the tray was the same as the eggs from the second fish, namely, sixty per cent.

From this and from other circumstances when the eggs are naturally deposited I believe that gold fish eggs must be hatched either immediately below the surface or not more than three inches. The adhesive character of the gold fish eggs is very pronounced. Any eggs placed upon a tray glued themselves fast to the cheese cloth and they could not be moved by any oscillation of the tray and in three cases out of four attempts to pick the eggs resulted in breaking the shell. Not one of the six gold fish, male and female, handled died and none seemed to be affected in the slightest degree by the handling.

DISCUSSION.

Mr. J. W. Titcomb, Washington, D. C.: I think that is very interesting and a novelty. I hope Mr. Berkhouse will continue the experiments, and trust that he will meet with better results.

THE MUSKALONGE OF THE OHIO BASIN

BY HON. TARLETON H. BEAN, OF ALBANY, N. Y.

This species was first described in 1854 by Dr. Kirtland from a specimen taken in the Mahoning river, Ohio; it was known, however, much earlier (1818) to Rafinesque, who stated that it reaches a length of five feet.

The barred muskalonge is found in Lakes Conneaut and Le Boeuf, in Pennsylvania. In August, 1902, Mr. F. J. King, of Waterford, Pa., caught an individual measuring four feet seven inches and weighing forty-four pounds two ounces. Lake Le Boeuf empties into French Creek, a tributary of the Alleghany river. In this lake the muskalonge frequents weedy bars around the entire lake and a smaller bar running through the middle.

During the investigations conducted by Prof. W. P. Hay for the United States Bureau of Fisheries in 1899 and 1900, a muskalonge eight inches long was obtained from Deckers Creek, above Morgantown, West Virginia. This is recorded in the bulletin of the bureau, Vol. XXVII, 1907, p. 37.

This muskalonge is a beautiful fish, and excellent for food. Its color is olive green with golden tints, and with a wonderful iridescence which the artist has expressed most happily in his drawing. On the sides are from twenty to twenty-three irregular, dark, crossbands, with some intervening partial bands and blotches. The lower third of the breast fin is pink. The tail fin and anal show dark blotches forming pseudo bands. The iris is lemon yellow on a white silvery ground, or sometimes, in smaller individuals, almost vermillion and orange. There is a dark blotch at the upper edge of the gill cover. There are no roundish black spots, so characteristic of the St. Lawrence river muskalonge.

Those who may desire to compare measurements of the Chautauqua form with those taken from muskalonge of the St. Lawrence river or great lake region will find tables in bulletin 60 of the New York State Museum, Catalogue of the Fishes of New York, page 305. It must be said, however, that the meas-

urements aid little in distinguishing the two races, and if northern individuals are barred like the Ohio basin form, it will be necessary to revise our ideas about distribution at last. The muskalonge in Chautauqua Lake has been known to reach a weight of fifty pounds, and it is justly regarded as one of the best food fishes of those waters. In the spring of 1895, when eggs were being collected for the Bemus Point Hatchery, it was not unusual to take individuals weighing from forty to fifty pounds, and many fish ranging from twenty to thirty pounds were captured.

When the lake becomes very clear, in February, the fish go into deep water, and they live in deep water more or less all the year. In winter, they frequent nearly the same localities as in summer, usually in the vicinity of water plants.

For fish culture operations pound nets are set at a number of places near Bemus Point as soon as the ice leaves the lake. The fish begin to spawn a few days after the ice is out and continue until the latter part of April. They spawn in comparatively shallow water, ten to fifteen feet deep or less. A few eggs were found in the stomach of a catfish near the mouth of a creek where the water was only five or six feet deep, and they were so recently swallowed that they were uninjured, and some of them were afterwards developed in the hatchery.

The muskalonge does not resort to the gravelly bottoms, like many other fish, but to mud, usually going into bays.

The males are smaller than the females and very little milt suffices to fertilize a large number of eggs. A female weighing thirty-five pounds yielded 255,000 ripe eggs. The eggs are about one-eleventh of an inch in diameter, and 74,000 fill a quart measure. They are semi-buoyant and non-adhesive, like white-fish eggs. Under favorable circumstances about ninety-seven per cent of the impregnated eggs have been hatched. In the early experiments with artificial culture some eggs were hatched in fifteen days with a water temperature of fifty-five degrees Fahrenheit. The fry when first hatched are very small and quite helpless. The yolk sac is absorbed in about fifteen days in water at fifty-five degrees.

According to E. W. Irwin, of Mayville, N. Y., he was the first to suggest a hatchery for muskalonge at Bemus Point. He

states that Seth Green sent Jonathan Mason to his house in May, 1887, and the first attempt was made but failed as the fish had finished spawning. In 1888 Mr. Mason renewed the experiment and, with the help of Frank Cheney, he collected and hatched eggs of the Chautauqua muskalonge artificially for the first time.

The eggs were hatched in a box with wire top and bottom, suspended about four feet from the bottom in eighteen feet of water. Since that time eggs have been developed in boxes placed in a small pond formed in the little creek which flows through the hatchery grounds. At the present time the eggs are placed in glass jars and hatched like whitefish eggs in artesian water with a uniform temperature of about forty-eight degrees. The embryos are too heavy to swim out of the jars, and, therefore, they are transferred at the proper stage of development to trays in boxes placed in the hatchery troughs. These boxes are fitted with wire at each end, to insure a direct and uninterrupted flow of water, which prevents the banking up of the fry at the lower end of the tray.

In 1906 the egg-taking season on Chautauqua Lake began April 18, and on April 30 Foreman Brown reported that the fish were about done spawning below Bemus Point, but were nicely started up the lake. A snow storm in late April delayed the spawning. On May 7 Mr. Brown reported that 7,000,000 eggs were in the hatchery. On May 16 one jar of eggs commenced to hatch. The shell of the egg was very dark—almost black. Premature hatching occurred in some cases, very likely on account of the difference in temperature between the lake water and the water of the artesian well, a difference amounting to seven or eight degrees. When eggs carried in the lake water were placed in the jars at the hatchery during such a difference of temperature many of them hatched prematurely.

He finds the cold water very bad for hatching muskalonge eggs. They do not develop properly. Some of them have no shell when they hatch. The fry are small and weak. They never used to hatch that way in warmer water; the fry would be black and strong, and almost twice as large. It is against nature to hatch the eggs in cold water; the water should gradually grow warmer. Lake water is the best for them.*

June 1, Mr. Brown wrote that in handling the eggs the poor ones will burst; they all bunch and stick together; it is impossible to do anything with some of them.

Mr. William Buller, of Corry, Pa., has hatched muskalonge eggs on the finest trout trays in water at a temperature of forty-five degrees. He stated that the hatching period was sixty-two days, and that the fry obtained were fine and healthy.

Excess of air in the artesian well water at Bemus Point, May 27, 1907, made it impossible to keep the eggs in the hatching jars. Mr. Brown was advised to transfer them to boxes in the little creek in hatchery grounds, or to run them in the fry boxes in the hatchery troughs.

He was afraid to transfer the eggs from cold to warmer water and, furthermore, the eggs were so tender it would not do to handle them. Air bubbles do not come on the eggs until they are about ready to hatch and as soon as they hatch the bubbles collect on the fry. Fry eggs, good and bad, all run out together into the pond. He collected them in the pond and put them back in jars. It is a bad mess. The fry do not carry very well in the troughs. Eight boxes (or 80,000) were lost and there was no apparent cause for their dying.

On June 7 I suggested to Mr. Brown that he might flow the water a long distance before allowing it to enter the jars and troughs. Or he might rig up a wooden trough or flume, open at the top so as to increase the distance between the point of delivery and the eggs or fry to be handled. The best way out of the difficulty, as long as artesian water is used, would be to receive the supply into a big pond or box and let it pass into another box before entering the hatchery. A fine screen placed in the course of the flow will help to break up the air bubbles. But the proper solution of the trouble would be to pump water from the lake in much larger quantity than is available at present.

If we continue to use artesian water, another well should be put down and it should be run into a large reservoir before coming into the hatchery. Mr. Brown cannot see why there should be so much air this spring (1907); there was very little in the spring of 1906. In some cases the fry would not carry well in troughs; they would be all right for about four or five days and then begin to die. The loss in this way was between 150,000

and 200,000. The last shipment of fry was made June 17 and there were a few more to be planted in Chautauqua Lake. Mr. Brown did not attempt to rear any in 1907.

The muskalonge kept in a small creek in the hatchery grounds at Bemus Point grew faster than those in the artesian water in the hatchery troughs and ponds. The artesian water apparently lacks something which the young fish require.

Muskalonge fry can be kept very easily until they begin to swim up, but after that period the losses through cannibalism are so serious that it has been found impossible to rear them either at Bemus Point or at Corry, to which latter station some of the eggs and fry from Bemus Point were shipped in exchange. On June 28, 1907, Foreman Brown was still holding 100,000 of the fry at Bemus Point. On May 30 80,000 of the fry were taken to Corry, Pa., in two rather small cans. The shipment was successful, notwithstanding the crowded condition of the fry and the high temperature of the air.

The embryo muskalonge does not swim up as soon as the young of most other fishes, and it is much affected by the quality of the egg. Sudden changes of temperature of the water injure the egg very seriously. The lake water warms up very rapidly during the egg taking season so that a difference of seven or eight degrees is often observed when the eggs are transferred from lake water to hatchery water. This seems to account for the rather small percentage of fry obtained from eggs—a percentage sometimes not exceeding sixty degrees. The best water for developing this species is, undoubtedly, the lake water which could be introduced by pumping. Incidentally this would be the means of increasing the capacity of the Bemus Point station to any desired limit.

Many attempts have been made to rear the muskalonge to fingerling size, but none have succeeded on account of the cannibalism so characteristic of the young. The fry are liberated as soon as they are able to swim freely, and most of the product of the hatchery is placed in Chautauqua Lake. The young fry are usually ready for planting about the end of May, or in June.

The best illustration of this muskalonge is the color plate by Louis Rhead in the report of the New York Forest, Fish and Game Commission for 1904-1906, recently published. The study

was made from an example caught by the artist in Chautauqua Lake in the fall of 1906. A black and white picture, adapted from the original drawing, was used by *Forest and Stream* on its cover page November 3, 1906. Mr. Rhead's account of his experience in fishing for this species, published in *Forest and Stream* of the date mentioned, contains interesting facts about its feeding habits and its actions when hooked. He considers this fish the best of its race from every point of view.

Mr. Rhead found that live or artificial minnows are not taken until fall, and that spoons of different shapes and sizes are used successfully in the early part of the season. His first success came on a luminous tandem, smaller than muskalonge spoons, and a good lure, close, compact, and the triangle hook well covered with feathers. At the suggestion of R. R. Brown in charge of the hatchery at Bemus Point, he tried a spoon made by a local expert angler, and found it so meritorious that other lurers were scarcely used. The spoon is made of brass, copper, steel and gold. Instead of the customary triangle, it has a powerful double hook, curving downward and ingeniously covered with bucktail, a red feather on each side, and just a touch of peacock's feather to give brightness.

The mode of fishing practiced by local anglers and guides is to troll with rods placed in sockets on each side of the boat, and two hand-lines worked closer in toward the boat, so that four spoons at varying distances require attention nearly all the time. Working as they do toward and in the weeds, better success is likely to ensue, though added trouble is caused by reason of snags. In trolling, a noiseless boat is necessary, and even and regular rowing. One trip over a strip of water is no criterion of its possibilities. A day's patient fishing in one place is surest, for the muskalonge is a swiftly moving fish.

Muskalonge have been taken that were literally crammed with fishes of various sizes and kinds, showing they were not hungry. The number of fish swallowed during a single summer is almost incredible. They are not minnows and small fry only, but large enough to reproduce their kind. In rowing over Chautauqua Lake Mr. Rhead saw many good-sized fish floating on the surface, not yet dead, with great gashes and pieces of flesh

torn off, telling of slaughter among the smaller fishes, which are constantly leaping from the water in terror of this formidable foe.

SOME REASONS FOR FAILURE OF FISH PROTECTIVE LEGISLATION AND SOME SUGGESTIVE REMEDIES

BY OREGON MILTON DENNIS, FORMER STATE GAME WARDEN OF MARYLAND, OF BALTIMORE, MD.

In speaking of the subject of "Some Reasons for Failure of Fish Protective Legislation and Some Suggestive Remedies," I want it distinctly understood in the beginning, that, while my language may appear to be harsh and my criticism severe with reference to some causes for the failure of the passage of proper and effective fish protective legislation, I am dealing with this subject in generalities, and without particular reference to any person or protective association.

I have come to the conclusions which follow, after very careful deliberations, and shall deal with it as I have with every other matter with which I have had to do,—in an honest and fearless manner—my sole purpose being to aid in fish protection, and pointing to some of the reasons why it has failed.

A long experience as secretary and council of a large protective association, and as the state game warden of Maryland, as well as a legislative experience, has, I believe, fully qualified me to express some opinions on the subject matter of this paper. Of course, this experience has been gained in my own state, and what I shall say will deal largely with the conditions in that state, a state having the richest bodies of water, commercially, in this country.

The political division of Maryland in the representation in the legislature, through its county members, places the control of legislation within the power of the counties, notwithstanding the fact that while more than one-half of the population is centered in Baltimore City, the latter only has about one-fourth of the delegates. I mention this because very largely protective influences originate in the city of Baltimore, and its chief protective association is there, composed of men who, whether intelligently or not, frame the bills that are presented to the legisla-

ture for its action. I say intelligently, because while its membership represents some of the wealthiest and best of our citizens, its enthusiasm for protection of both game and fish and the bills framed is largely based on selfish reasons as sportsmen, and largely without regard to intelligent conclusions with reference to the right of the commercial fisherman, the vote of which class is sufficiently large in tidewater sections of our state to control the electorate. This being true, the county members of the legislature, as well as the fishermen themselves, look with suspicion upon any and all measures presented to the legislature, which have for their purpose the protection of fish and game when such measures are presented by city men. Growing out of this condition about two years ago a Fishermen's Protective Association was formed in Maryland for the distinct purpose of fighting the city association, whose only interest, they believed, in protection was, to secure to the angler a good day's fishing without regard to his, the commercial fisherman's interest. This condition grew out of a policy of the Game Protective Association introducing measures abolishing the use of all sorts of nets, or so restricting their use, that the commercial fisherman would be put out of business. I am happy to say, however, that during the past year as state warden, I believe that largely through my own efforts both the associations at the last session of the legislature, united on a number of measures for fish protection, but, even with this combination, we failed in specific results.

Unfortunately, in my judgment, the selfish interest of one class and the suspicions of another, is largely the reason for the failure of proper fish protective legislation. The angler goes to the legislature with a bill based on his idea what the law should be—and that idea is usually the prohibition of the use of all sorts of nets which will interfere with his sport; another class of commercial fishermen prepare a bill to protect them in the use of the sort of nets that he fishes with, and still another set of fishermen with a bill to protect him in his method. The result is, that the legislative committee before whom these bills go, are pulled and hauled and besieged and worked upon by the various interests to such an extent, that the committee becomes disgusted and pigeon-holes all the bills, and none are passed.

Another reason is, that while the state of Maryland spends

thousands of dollars for fish culture, it persistently refuses to make any appropriation or to give the State Warden Department any material assistance in the enforcement of such laws as we now have, and while the state navy is charged by law to enforce the laws for fish protection, the character of their boats prevents them from going into shallow waters to do any work, even if it could take the time to divert the boats from oyster protection to do this.

What I have said above is but the foundation for specific reasons which I shall give for failure of protective legislation, and in my opinion can be reduced to the following, to-wit:

First—Up to this time, it is absolutely impossible to get the tidewater fishermen to agree on any bills; in my judgment, even if proper laws were enacted under the system in our state, they would absolutely fail of enforcement.

Second—I declare next to the above reason that the greatest reason for non-passage of fish protective bills, is the action and influence of the duck gunners of Maryland. This class of sportsmen either by purchase or lease, secure absolute control of water fronts in the tidewater counties for their ducking clubs and shooting grounds. These gentlemen, among the foremost citizens of our state, are largely residents of the city, and are jealous of the rights that they claim they have paid for, and in order that they may preserve them, are in constant conflict with the resident fishermen who ply their industry in the waters fronting on, or adjacent to, their shores. Being, as a rule, men of wealth and influence, there is small opportunity to prevail against that influence with the legislators, when there is a conflict between the rights of the duckers and the fishermen.

There are a number of other reasons which, in my opinion, prevent the passage of proper fish protective laws, but these are sufficient for any purpose.

Now as to the remedy. I shall offer but one, but I think this will be sufficiently radical to bring down on my head all the knocks that I can stand up under.

You will remember that I made this suggestion at the last annual meeting of this society: "Admitting the necessity of protection of young fish after being placed in the waters by the states and the United States, the question that confronts us is,

how? I believe that if it comes within the constitutional powers of the government, congress should pass proper interstate laws for the protection of fish."

Thousands of dollars are being spent, practically wasted for fish propagation in Maryland. The state has persistently neglected to provide for protection. Not until after fifty years of constant agitation, and the practical extermination, commercially, of the oyster, has Maryland awakened, (and that but two years ago) to the fact that the oyster in Maryland must be protected or exterminated. If it has taken us this long to awaken to the serious condition of the oyster, how long will it take to recognize the necessity of the protection of the fish, and thus save to the people of our own state and other communities from extermination, one of the greatest natural food products of the world?

Mr. Bryan, at the conference on national resources, in Washington, in May last, in which the governors of the states and prominent men of the nation took part, said with reference to the protection of the great national resources of the country that "he regarded the development of water transportation as essentially a national product, because the water courses run by and through many states." In my judgment, it is just as important for the national government to protect the natural industry which has its life and being as a food product in and under the waters of this country, as it is to enlarge and protect the waterways for carrying away from, and bringing to us, the great commerce of the world. I believe it more important because the product of the water since the beginning of the world, has provided food and life to man long before he thought of the creation of great fortunes by the use of water courses for commercial purposes.

I am a state's rights man, and am jealous of any action of the national government which would deprive the state of a single right, but when you consider that the great bodies of water which produce natural food run by and through different states; when you consider that petty political influences, jealousies, and other equally silly reasons, prevent a state from protecting from extermination a natural product of food, notwithstanding it has legally determined that fish are the property of the state, I am con-

vinced that the only solution of this question is, that the natural control of the fish should be in the federal government, and I hope this society will put itself on record to that end, for I believe that not until this is done, and the federal government legislates for fish protection, and supplies its powerful backing to the enforcement of these laws, will the question of fish protection be solved.

SOME PECULIARITIES IN SPAWNING HABITS OF LARGE-MOUTH BLACK BASS

BY J. J. STRANAHAN, OF BULLOCHVILLE, GA.

Do fish spawn more than once a year? This is the usual way that the layman puts the question to the fish culturist and the answer is in ninety-nine cases out of one hundred in the negative. This would have been my answer nine years ago, or prior to my residence in the south. Of course we all know that carp and some other fishes of that family lay their eggs a few a day over a considerable period of time, but that is not the real question as applying to the more common fishes reared in confinement, such as the basses and other members of the *Centrarchioae* family.

I know of no place where the habits of fishes can be so well observed as at the Cold Spring Station of the United States Bureau of Fisheries at Bullochville, Ga. The water is extremely clear and most of the ponds are comparatively free from aquatic growth. The smaller ones are so restricted in area that observations can be made of all parts of the ponds in favorable weather. The writer has kept careful watch over the spawning operations of the large-mouth bass during the nine seasons during which time he has been in charge of this station, although the larger size of the ponds and the growth of aquatic plants made this work less satisfactory after the first two or three years. However, it is known as an absolute certainty that the large-mouth bass at this station spawn several times a season, extending over a period from early in March to the last of July, and usually in small numbers into August. In fact, we had one case where a male bass had a brood of fry numbering several thousand about an inch long on October 11. Fortunately, Hon. George M. Bowers, commissioner of fisheries, was present and saw this sporadic hatch.

There are generally individuals with distinguishing marks which permits us to identify them in these duplicate hatchings so that there is not a shadow of doubt as to the accuracy of these

statements, but as a further proof I make the following extracts from the annual report of the Cold Spring Station made July 1, 1900, and I would state in this connection that the opportunities were better then for close and accurate observation than during any year since, the ponds being few in number, small in size and almost devoid of vegetable growth. The work was carried out with all the care possible, Mr. J. B. Lamkin, fish culturist of the station at the time, being very methodical and assisting materially in the work, having specially in charge the work of recording the observations which he was instructed to make daily or hourly if necessary:

A few bass had spawned before the writer arrived, eight beds having been recorded prior to that time. Up to the 8th of May no very systematic record was kept as to the location and date of beds, but on that date an order was issued that all beds on which eggs could be found be numbered and marked with a strip of wood on which was to be placed the date and any other necessary data. Prior to May 8 twenty-four beds were located and recorded and after that date up to the 1st of July twenty-five beds on which eggs were found were numbered and dated, thus making a total of forty-nine beds on which it was positively known that eggs had been deposited.

There were but twenty-eight breeding bass on the station, all told, male and female. More than that we have two females which are much larger than any other fish in the ponds, weighing about six pounds each. These fish have spawned several times during the season.

There is another interesting feature in this connection. There is a male in one of these ponds which is conspicuously distinguishable from all the other fish because of having two splits in his tail, one of them extending back to the flesh. The employes of the station call this fish "Old Split Tail," because of this marked characteristic. No other fish is so marked and he is the largest male bass that has been observed caring for a nest. Since accurate numbering has been practiced this fish has fathered seven distinct lots of eggs on six beds. When the fry of the sixth lot were just large enough to raise from the bed a female came along which was ready to deposit her eggs. Being of an accommodating turn, he took her in, fertilized her eggs and

cared for them at the same time that he cared for the former brood, rounding them up and keeping them near the nest and finally bring out brood No. 7. He is a remarkably good father, there being as much difference in this respect with the bass as with fowls.

The third and fourth lots fathered by this fish were abortive, all eggs dying on the nest, he leaving them as soon as they had turned white. I believe that this is the rule, although I would want further chance for observation before announcing this as a settled fact. Eleven beds of eggs were thus abortive at this station this season, or at least appeared to be so. However, there were three of them which hatched a small percentage of fry and in these cases the male remained on the nest until the fry raised and moved away.

If I may be allowed a digression I would state that in examining this report I find a feature which may interest the fish culturists present, namely, that in water of a temperature ranging from 71 to 75 F. the large-mouth bass egg hatches in forty-eight hours and that the fry raise from the bed in from five to ten days, according to temperature, eight days being about the average. Eggs were taken from the beds as soon as deposited and at regular intervals. The embryo could be distinctly seen under the microscope and began to move and change position in the egg in twenty-four hours. When first hatched there was but little color on the eye and no pigment cells were discernable; red corpuscles clear as were all tissues; heart action distinct; single oil drop, lemon yellow in color. In twenty-four hours red corpuscles, amber color, eye almost black and pigment cells showing distinctly. Development from this on was very rapid.

HAWAIIAN "FISHERY RIGHTS"

BY JOHN N. COBB, AGENT UNITED STATES BUREAU OF FISHERIES.

Undoubtedly the most peculiar feature of the fisheries of Hawaii at the time of annexation was the well-established principle of private ownership in the fishes found in the bays and open sea in the vicinity of the shore, also in certain of the streams.

In order to understand these peculiar "rights" it is necessary to refer to the early days of the Hawaiian nation and trace briefly the evolution of its land customs and laws, with which these "rights" are closely interwoven.

Up to the year 1839 all the land of the kingdom was owned by the king, who, by his mere word could give or take away a piece of property. He was also supposed to own the land and water extending out to the reef, or, where there was no reef, for one geographical mile from the shore. Necessarily as he owned the waters and the land under the waters within these limits he also owned what the waters contained, and hence had the right to grant such to whomsoever he pleased. The bill of rights promulgated by the king in 1839 established the right of private ownership in land, and as a result all the powers which he had formerly exercised over these lands fell into the hands of the persons then owning them, the king retaining only his rights over what were termed Crown lands.

Nearly all of the available agricultural land is in the vicinity of the sea or its bays and tributaries. For convenience each island was divided into districts called "moku," and these were subdivided into "ahupuaas," which is the unit of lands in the islands. The "ahupuaas" are generally long, narrow trips, running from the mountain to the sea, and include the mountain, the plateau, and the shore. These great portions of land usually had attached to them ocean "fishing rights," in some instances not only adjacent to their own shores, but spreading out on each side up and down the rocky coast for miles, till they joined another monopoly of the deep-sea fisheries. In a few instances these "fishery rights" did not abut at all upon the land to which

they belonged, the latter being located in the mountains or on the plateau and not reaching to the shore, while in several instances the bounds of the fishery did not reach the mainland at any point. The fisheries attached to these "ahupuaas" generally extended to the reef, or, if there was no reef, for one geographical mile out to sea from the depth where a man could wade; some of the "ahupuaas" were granted by metes and bounds one mile and a half out to sea.

The "ahupuaas" were further subdivided into "kuleanas," which were small plots of land granted to the retainers of the "konohiki," or landlord, who controlled the "ahupuaa." The "kuleana" carried only the right to fish from where a man could wade up to about five feet.

On the island of Kauai exclusive "fishery rights" covering the rivers were also granted. There were two such "rights" on Hanalei river, and one each on Nukuhuliiia, Lawai, Hanapepe (running up both banks as far as the tide extended), and Huleia rivers.

The following were the number of "rights" on each island for which claim was made in the courts of the territory within the period specified by the enabling act admitting the latter: Hawaii, 11; Kauai, 28; Lanai, 2; Maui, 41; Molokai, 4; Oahu, 58; 144 in all. The largest recorded area covered by a "right" was one of the two around the island of Lanai, 4,152 acres. It is possible, however, that several whose areas have not been computed would exceed this one in extent. The fishery with the smallest recorded area was that of Haua, on the island of Molokai, which has an area of one-half acre.

Owing to its importance as the seat of government, and its larger population, the "fishery rights" of the island of Oahu were more numerous and valuable than those of any of the other islands. Close to Honolulu were two fisheries belonging to one person which brought in a yearly rental of \$1,375. On Kauai only a few of the "rights" were of sufficient value to be rented, these being mainly around Waimea and Hanalei, where one rented for \$200 a year, while another brought in but \$20 a year. Practically no effort was made of recent years to collect rent for any of the fisheries of Hawaii. This was largely owing to the sparseness of the population and the consequent lack of markets

for the sale of the fish, also somewhat to the disinclination of the people to pay rent. The only fishery on Maui for which anything more than a merely nominal rent was exacted was at Kahului, one of the most productive and best managed of the territorial fisheries. Merely nominal rents were exacted for the use of the fisheries around Molokai. Although numerous attempts were made by the owners to collect rent from the fishermen who frequented the waters around Lanai, they were almost uniformly unsuccessful.

Under the old laws the "konohikis," or landlords, were considered to hold these private fisheries for the equal use of themselves and of the tenants on their respective lands. The konohiki had power each year to set apart for himself, after due notice, one given species or variety of fish natural to his fishery. The specific fish so set apart was to be exclusively for the use of konohiki if caught within the bounds of his fishery, and neither his tenants nor others were at liberty to appropriate such reserved fish to their private use, and if one did so that konohiki could compel him to pay five fish for each one so taken wrongfully. Any person, not a tenant, fishing would be fined upon conviction. It was not lawful, however, for the konohiki to taboo more than one kind of fish upon fishing grounds which were adjacent to each other. It was competent, however, for the konohikis, on consultation with their tenants, in lieu of setting apart some peculiar fish to their exclusive use, to prohibit during certain indicated months of the year all fishing of every description upon their fisheries; and during the fishery season to exact of each fisherman among their tenants one-third part of all the fish taken upon their private fishing grounds. The more enlightened konohikis made excellent use of this provision to protect the more important species, notably *amaama* (the mullet, *Mugil dobula*), from pursuit by the fishermen during the spawning season.

In Hawaii, as in many other countries, there were what were known as "royal fishes." The list was a long one and comprised the following:

The bonito (*Gymnosarda pelamis*) when off any part of the coast of Lanai.

The albacore (*Gerimo sibi*) of Hawaii.

The mullet (*Mugil dobula*) of Huleia, Aneholo, and Hanalei; squid (*octopus*) and freshwater fishes (*Gobies*) of Kauai.

The shoal fish taken at the following places noted for the abundance of fish frequenting them: Off Oahu—Kalia, Keehi, Kapapa, Malaeakuli and Pahihi. Off Molokai—Punalau, Ooia, Kawai, Koholau, Kaonini, Aikoolua, Waiokama and Heleiki. Off Maui—The Kuleku of Honauula, and the same whenever found off said island.

All the following transient fish, viz: The kule (*Trachurus crumenophthalma*); the anaehole (a young mullet); the alalauwa (*Priacanthus cruentatus*); the unhuakai; the kawelea (*Trachinocephalus myops*); the kawakawa (*Gymnosarda alletterata*) and the kalaku.

When any of the above species were taken by the fishermen they were to be divided equally between the king and the fishermen. Owing to the fact that it was found to be a difficult matter for the king to collect his share, and the officers appointed for the purpose were found, in some instances, to be oppressing the people, the government in 1851 passed a law granting to the people the free use of the government fisheries, reserving only the right to establish taboo seasons when deemed necessary for the protection of the fisheries.

As these "fishery rights" appeared anomalous and inconsistent with the customs and laws prevailing in this country, the congress, in the enabling act creating the Territory of Hawaii, which took effect June 14, 1900, repealed all laws of the former republic and kingdom which conferred such exclusive rights, subject, however, to vested rights, the latter, however, not to be valid after three years from the taking effect of the act, provided the owner had filed his claim to such in a circuit court of the territory before June 15, 1902. In the event of his establishing such right the territory was authorized to condemn it for public use upon making just compensation to the owner. The territory fought the claim that these were vested rights and two of the cases were finally passed upon by the United States Supreme Court, which upheld the contention that they constituted vested rights. Practically all of the cases have now been adjudicated by the territorial courts and the only thing remaining to be done is to fix upon their values and then pay for them.

MEETING OF COMMITTEE ON SIZE OF FISH, AMERICAN FISHERIES SOCIETY

Washington, D. C., September 21st, 1908, 6 P. M., at Arlington Hotel.

The committee consisted of Mr. Frank N. Clark, of Northville, Mich., chairman; Mr. W. F. Meehan, Harrisburg, Pa.; Dr. S. P. Bartlett, Quincy, Ill.; Mr. Charles G. Atkins, East Orland, Me.; Mr. J. Frank Ellis, Washington, D. C., (substituted for Mr. John W. Titecomb, Washington, D. C.); Mr. Seymour Bower (substituted for Dr. Hugh M. Smith, president of the American Fisheries Society), and Mr. Henry T. Root, Providence, R. I.

There were also present a large number of the members of the American Fisheries Society, who had been invited by the chairman to attend.

The following proceedings were had:

Chairman: This is a meeting on the size of fish, and the committee are now ready to hear from any who wish to make any statement in regard to the size of the fish, and the committee will have a chance to discuss it too.

Mr. Bower: I judge from what Dr. Bartlett said at the meeting of the society that he had something of importance to present with reference to the present standard.

Dr. Bartlett: It gives me pleasure to talk upon this matter in the presence of my old time friend, Clark, and while our interests may run counter as to the size of fish, I have some decided ideas as to the proper numbering of them.

As you all know, my work is practically the work of collecting and distributing black bass. The conditions in Illinois are that the water is too warm to sustain the life of the trout, the temperature often reaching eighty or ninety degrees. Consequently our black bass grow large very early, and it is not uncommon at the end of October to find black bass of that year's spawning weighing anywhere from six to eight ounces, and occasionally ten ounces. The earliest product that we take will probably be one inch in length. We have our orders to ship a careload of

fish, to gather them, and our fish may run anywhere from one to two inches in length. The rapid increase each month makes the difference in size at a wonderful variance. It is almost impossible to give the people in Washington with whom we have to deal, a correct idea as to the size by number. For instance, a number one black bass would technically be one inch, but under the ruling it remains a number one bass at two inches. Now a number one bass at one inch is a very minute creature, and a number one bass at two inches will weigh four or five times as much as number one. We may possibly put up the first catch of black bass, 300 or 400 to a can, while if they are two inches long 150 will be all that the can will hold. So that in getting our orders from Washington to distribute 10,000 fish in a carload, we are in trouble. Last week I had an order from Washington to put 10,000 black bass in a car, and all we could put in was 3,500, because the fish had increased in size so rapidly.

I would suggest that the numbers instead of running by the inches, run, for instance one inch, number one; one and one-quarter inch, number one a; one and one half inch to one and three quarters, number one b; and so on up.

I make that suggestion to fit the conditions present in Illinois. I am not here to dictate what ought to be done for different stations or places. I am talking about the conditions that exist in the warm water of the state of Illinois. That would be my suggestion.

Mr. A. G. Keesecker, Erwin, Tenn., (Supt. Bureau of Fisheries Station): I would like to say that my principal objection to the present system is that the number is taken from the largest size of fish. For instance, the number two is a fish from one to two inches long.

Mr. Meehan: No, number two is over two inches long and less than three.

Mr. Keesecker: Then why not make this run the other way and instead of making that number the limit of the size make it the medium? The gentlemen that are raising trout will understand that trout vary in size and length very much, and unless you keep grading them very often there will be a variance in size, and my way of numbering would be to strike the average size

of the fish and to call them by numbers; and it seems to me that this average size ought to be the midway size instead of being either the smallest or largest fish that are designed by a number. Suppose we call a fish one and one-half inches long, number one, and from one and a half to two and a half number two, making the number the midway size of the fish, letting the average be half each way.

Mr. Meehan: My recollection was when we agreed upon making numbers that way, namely, number one from one inch up to two, and so on, was for the very reason that Mr. Keeseecker has stated—that we were speaking particularly of trout, and that trout in a trough would vary in size in a very short time, from one to two inches; and therefore we took the number one as representing the average fish, that is, from one inch to less than two, and I consider it to be the fairest and best means of designation. Of course it was more particularly trout that we were talking about, but we applied it to all fish.

Mr. John L. Leary, San Marcos, Texas., (Supt. of Station): Our fish grow very fast and the term fingerlings does not apply to our later fish at all. They ought to be called yearlings. But I believe if we would say that fry and advanced fry should be the designation given to fish up to one inch, and then for all from one inch to two inches number one, and two inches to three number two, that that would be a better plan.

Mr. Meehan: It is so stated. A fry is a fish with a sac on; it is an advanced fry when the sac is absorbed; and it is less than one inch in length; and it is number one when the fish is from one to two inches long.

Mr. E. N. Carter, St. Johnsbury, Vermont: I think we had better make use of weights in connection with the numbers; for instance call them 1, 4s, or, 1, 5s, the 5s designating the weight of the fish, or something of that kind. I do not know what a good bass of a certain size would weigh, but it seems to me it would be easy to determine that by means of properly constructed scales, and we would know that the number one would refer to a fish between the length of one inch and two inches, and, as has already been pointed out, fish running from one to

two inches may vary greatly in size and weight, and I believe that a more definite determination could be arrived at by using the weight in connection with the method already adopted.

Mr. Henry T. Root, Providence, R. I.: I would say that that is the way we buy our trout, by weight. I will go down and order a hundred trout but I order them by weight. We get less trout as the fish advances in weight, but people are better satisfied, and I do not see why that principle cannot be applied to all fish.

Mr. Meehan: You would have a great job with whitefish.

Mr. Carter: The system of weights is used all over the country. A pound is a pound everywhere. If Dr. Bartlett weighs a lot of fish and knows a certain size has a certain weight, he can telegraph to Washington, and they will know just what those fish are.

Dr. Bartlett: The purpose of this inquiry, as I understand it, has been for the convenience of the gentlemen at the head of the Bureau of Fisheries, and covers the work of twenty-five or thirty of us in the country who are superintendents, and it is to arrive at some kind of a fixed plan by which they may know what we are giving them, that this meeting is called. I suppose the service is the same with all, and the proposition, as I understand it, is that when we have shipped a carload of fish we ought to give an approximately correct idea of what we have actually shipped. With black bass it is hard to do that, where you have a number one running from one to two inches. I do not know anything about trout work, or in the growth of trout how it would be applied. I am talking simply from the standpoint of those black bass that are taken from sloughs where the waters are very warm and they grow very rapidly, so that by the time we have cleaned out a pond we may have a dozen different sizes, and we may take fish out of some of those places where we would have many fry that would go from one inch up to two inches, and lots of them that would go up to four or five inches. I know it is a little bit difficult, and perhaps I am a little bit selfish in insisting on the committee changing the regulations as to size, but those are my reasons. I am only speaking for one locality and not as applied to the whole.

Mr. Bower: I do not see how the doctor is going to tell how many of each particular kind he has, if he draws the line too fine. The fish will vary an inch or two in length in the small hatch. Now if we get down to quarter sizes how will we tell the number of each without sorting and counting? As long as we all use the same standard and strike a fair average the presumption is we will have as many a little under size as over size, and it is as fair for one as it is for another. I do not see how we can draw the line as fine as a quarter of an inch as bass grow so rapidly and unevenly. I believe it will be impracticable to separate them into quarter inch sizes. I do not see how we can work the doctor's plan, thought perhaps Mr. Root's plan of weighing them is all right.

Dr. Bartlett: But with us we separate our bass closely as to size in troughs while holding them there, and I do not know how you find it in your hatcheries, but certainly a quarter of an inch makes enough difference in size frequently for a very rapid destruction of fish if held any length of time, and if they can be separated into those sizes why cannot they be separated so as to account for them by number? This is simply a suggestion and simply applies to my individual work, as I say, and I present it so that it may be considered.

Mr. Lydell, Superintendent, Mill Creek, Mich.: The present plan suits me very well. If we sorted our bass as number one a tonight, tomorrow morning they would be number one b, and when I say to the fish commission I have put out 100,000 number ones, they know they are between an inch and two inches, and if you want them closer, say number two from one and a half inches to two and a half inches, but do not cut it any closer than half inches; but we have no trouble under the present plan. If a fish culturist can ship his fish number one, he will not wait for two inches, and call them number one. I have shipped 190,000 number ones this year, and not one over an inch and a half. I think that would be the policy of all culturists—if they can ship them and call them number one at an inch, they will not wait till they are two inches. Of course it is possible when fish are collected from sloughs and in a number of lengths something

like the plan suggested by Dr. Bartlett would be better, but the present plan suits us in Michigan very nicely.

Chairman: You chairman wants to say a word or two. I have looked this audience over here, and it is larger than some of the American Fishery Society meetings that I have attended. I am glad to see so many, and I notice that there are present here seventeen practical fish culturists. This of course includes Mr. Meehan, which is a little doubtful but we will let it pass. (Great laughter.) Now of those seventeen, they have been working on this basis of number one, two, three, etc. Now how many of those seventeen are dissatisfied with the present plan? I would just like to know for the sake of argument. I will ask all to hold up their hands that are dissatisfied with the present plan.

A vote was then taken which showed eight to five in favor of the present plan.

Dr. Bartlett: I submit to the majority.

Mr. Clark: Of course this is going to be finally left to the committee, but I would just like to ask why this would not be a good plan to get at what the doctor wants:

Number ones: $1\frac{1}{4}$ inch.

Number ones: $1\frac{1}{2}$ inch.

Number ones: $1\frac{3}{4}$ inch.

Then number two: 2 inches, $2\frac{1}{2}$ inches, and $2\frac{3}{4}$ inches, and so on. Why is not some such plan as that best?

Mr. E. E. Race, Superintendent, Green Lake, Me.: Why add more to our arduous duties, without giving us better results? Why have six or seven designations instead of those we already have? In other words, if the designations now are for bass only, I do not know how it works; but for brook trout and salmon, land-locked, it would be impossible to weigh them at this season because they would die before transporting them five miles from the station. I have thought the thing over very carefully for several years, and it seems to me that the way it is now arranged, for all practical purposes, both for the bureau and stations, it will be very hard to improve. It might be of advantage for some localities, but take it as a whole it would be very unwise to change it.

Mr. Bower: We might make one more subdivision and help the doctor out a good deal in his work in this way:

Make number one cover fish from 1 to $1\frac{1}{2}$ inches in length; then, 1 plus, fish from $1\frac{1}{2}$ inches to 2 inches; then let number 2 cover fish from 2 to $2\frac{1}{2}$ inches; and 2 plus cover fish from $2\frac{1}{2}$ inches to 3 inches in length, and so on. That is simple. Just add "plus" for the last half inch and leave it off for the first half inch.

Mr. Race: In the station where I am located we have a large number of fish. In one pond are fish four to five inches long, and in another pond the fish are smaller, though they are of the same age, and might be designated as number one while the others are fours. If the fish were all uniform in size it might be possible that it would be advantageous to make the change, but when we have so great a variation in the different ponds it seems to me it is impossible to improve on the present plan.

Mr. Charles G. Atkins, East Orland, Me.: I wish to second what Mr. Race says, that if you subdivide the fish any more you increase very greatly the difficulty of estimating their sizes. We cannot stop and measure them. We have got to look into the water and guess at them; and it seems to me when they are arranged as they are now, that the guessing is about as close as we can make it, and about as near as we can get at it.

Mr. Carter: Up at St. Johnsbury we screen our fish. At Arlington where we raise fish we have a series of screens of various sizes. Mr. J. P. Schneider started this thing over at Arlington, and we have our fish in a trough, may be 2,000, 3,000, 4,000, or 5,000, whatever they are, and we start one screen at one end and one at the other end, and work one screen to the center, and commence at the head of the trough and work the other screen towards that; and you will be surprised to find how equally we can sort the fish out into two sizes. In a short time you can sort a great many thousand fish without injury to any single fish.

Mr. W. T. Thompson, of Leadville, Colo., (Supt. of Station): I want to say a word about the measuring of fish. Of course when we have had any rule in force for a while we are likely to find the little weakness in it. Some one presents a new

idea, naturally presenting only its best side. We do not see the weaknesses in this new proposition until we give it our careful consideration. Take this weighing of fish, take fish of the same size, say an inch and a half or two-inch fish, compare those raised in cold water, with others raised in what we would call comparatively warm water; those in the warmer water will eat a great deal more, they grow rapidly, and will be deep, broad and heavy, probably weighing from one and a half to two times as much as fish grown in cold water. The cold water fish do not eat as much and are much more slender. Now here is a chance for variation in weight just as much as in length. On the other hand you talk about subdividing them into fingerlings one, one and a quarter, one and a half, and one and three-fourths inches in length. How many troughs do you get hold of where you can get the division down that fine without weekly, I might say daily, sorting? You call them fingerlings number one and will have fish varying at least a half inch, possibly more. It will be the same way all along. Now how are you going to get down quite as fine as a quarter of an inch? Even if you do, what practical purpose will be subserved anyhow? When you start in with a fingerling number one, naturally you ship more to the can, if your season is prolonged for a week or two it is true you get a few less in the can. But it is impracticable to get it down to the absolute unit; we cannot stop and count each individual fish. Take our case at Leadville: We have forty-eight nursery pens. When we make a shipment it usually means from seventy-five to one hundred and fifty cans. We move practically all our fish in special cars furnished by the railroads. Now we cannot get down that fine, to the absolute unit, I mean, and I do not believe anyone else can. It is not practical where you are handling large numbers of fish. What can you gain by it anyhow, except to put a little more work on the already hard-working superintendents?

Mr. H. D. Dean, Superintendent, Neosho, Mo.: I believe a letter would be better than a figure. Then why not, if you put 100 in a can, 100 number one, 200 number two, and so on up to a thousand, tell the Washington office right away how many you think you could ship in a can.

Mr. Thompson: Difference of opinion still.

Mr. Dean: Then there ought to be a machine made to run through and tell exactly what the fish weigh and Washington should furnish the machine.

Mr. Bower: The Washington authorities should give superintendents more leeway and let them ship what size is best in their judgment.

Mr. Lydell: I do not think numbers per can would do any good. We sometimes put 100, 200 or 500 in a can, according to the distance we ship, although the fish may be of the same size. That would be very misleading I should think, in that way.

Mr. Ellis: I think the present arrangement suits the office very well. If there must be a change I think Dr. Bartlett's is the best proposition—not the quarter but the half inch.

Chairman: Why not put plus on them, as Mr. Bower suggests?

Mr. Ellis: I think it would be better for the records to use a, b, c, number one a, etc., and that would mean the half inch.

Mr. Lydell: If we change the present plan we will cause ourselves a whole lot of work.

Chairman: What does the committee think of this plan? For instance, number one a, number one b,—number one a would be from one inch to an inch and a half, and one b would be from an inch and a half to two inches, etc., and let those use that that want to. If I am sending out fish I prefer to use number one all right. That suits me and I use it. They are number ones. Now if I care to or if our office or if Mr. Lydell in the state cares to use it, or if his superintendent wants him to use it, then he will do so. Let it be optional with the different commissions. Mr. Bower concludes number one is good enough for them, and number one may mean an inch or an inch and three quarters; it is optional with him to use it, and it would be optional with the United States, or Connecticut or Rhode Island, etc.—we must formulate some report.

Mr. Meehan: Then we will be getting into confusion. We have got to consider something else besides our office work or the

hatcheries; we have got to consider that for years we were all mixed up with the people themselves. When the state shipped directly to the people one would call the fish fry, another would call it fingerling, etc. Now we are beginning to make the people who receive fish understand what we mean when we say fingerling and fingerling number one. Now if we make a change again and quit that making it plus or a, b, c, or whatever you may call it, we must teach the public all over again; and I think that any change should be made with the greatest of caution, not only on account of the extra work which it will give the superintendents and the office, but the trouble again with the public; and I myself believe that we ought to hold to the regulations that we now have without change. I think it would be a mistake to make it optional. If we do make a change it should be recommended as general so there won't be the confusion among the different states again. There would be confusion if Michigan put in a, and Rhode Island kept the fingerling, and Pennsylvania kept to a1, or b1, or plus—there would be confusion again, and I do not think it would be good policy.

Dr. Bartlett: I confessed on the start that this was practically a selfish matter, so far I was personally concerned. Drop the black bass for a moment and go on to the bream. Now there is a fish that we commence moving at from three-eighths to one-half inch in length, and the crappie is practically the same. If you get a bream or crappie that would go an inch and three-fourths, you have a fish way beyond number one, because it must be late in the season before it would attain that size.

Mr. Meehan: I understand what our men mean when they say number one bream. I understand they have got them between one and two inches.

Mr. Leary: We should drop the word fingerling as to fish under one inch long. Say fry, advanced fry, number one and two, and then commence: number one fingerling, number two fingerling, number three fingerling, number four fingerling, number five, six, seven, eight, nine and ten fingerling, and that would cover the bream, crappie and all other small fish.

Mr. Atkins: It seems to me that those who wish to subdivide

fish still more, or are called upon to do so, might make such a division as this: Small number ones, medium number ones, and large number ones. It seems to me that would be entirely satisfactory, and the regulation could remain as it is. Those who do not choose to designate the fish in that way need not be compelled to do so.

Chairman: If there is nothing further to be discussed, what does the committee wish to do about this?

Mr. Carter: We have one, two and three fingerlings and then come to yearlings, etc. How do we designate and distinguish between yearlings and adults? When are they adults. I do not think that has ever been settled.

Chairman: I call a fish an adult when it is ready to spawn for the first time. A trout is adult at eighteen or nineteen months, and small-mouth black bass become adult at three years old.

Mr. Carter: There should be some age set as to when they are called adults, for the sake of uniformity.

Mr. Meehan: The regulations call for one year old, two year old and three year olds.

Mr. Bower: I was born and raised on a farm, and in that section calves are always called yearlings until they are two years old, and two year olds until they are three; so with fish, they should be called yearlings until they are two years old; that is, the universal rule and custom.

Mr. Meehan: That is so with us, and that is supposed to be the regulation.

Mr. Meehan: I move that this committee report that it is inexpedient to recommend a change in the present regulations.

Mr. Bower: I support the motion.

Dr. Bartlett: I move that the present regulations, with the exception of dividing by the half inches, be retained, and I move to amend the motion by making it into the half inches, that is, number one running up to the half, etc., as suggested.

Mr. Bower: How do you designate it? One a, etc.?

Dr. Bartlett: The designation, "number one," could be used for a fish from an inch to an inch and a half in length; "Number one A," for a fish from one and a half inches in length to two inches in length.

Amendment seconded.

Mr. Bower: This having both A and B is confusing. It makes B mean more than A, whereas A usually has the greater value. The plan I suggested of using the term "plus" is correct in principle, but I think Mr. Ellis' and Mr. Dean's idea of using a letter is much better. Call all fish from one to one and a half inches in length, No. 1; from one and one-half to two inches, No. 1-A; from two to two and one-half inches, No. 2; from two and one-half to three inches, No. 2-A, and so on. I will support that plan.

Mr. Meehan: I will accept that amendment.

Dr. Bartlett: I support that.

Chairman: Then I understand that it is Number one from one inch to one and a half; and Number one A from one and a half to two inches.

Motion put and unanimously carried.

Chairman: The chairman agrees to it and the committee will report in that way, that the present regulations be amended to read accordingly.

The committee reports that the regulations regarding the size of fish remain the same, excepting that there be a subdivision of the numbered fingerling class to be designated by the letter a, to-wit: Fingerling number one, one inch and less than an inch and a half; Number one A, one and a half inch, and less than two, and so on.

The committee then adjourned.

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1908

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Leary, John L., *U. S. Bureau of Fisheries, San Marcos, Texas.*
Leis, Herman, *Melvina, Wis.*
Leisenring, W. A., *Commissioner of Fisheries, Mauch Chunk, Pa.*
Lewis, C. C., *Northville, Mich.*
Lewis, Charles E., *Chamber of Commerce, Minneapolis, Minn.*
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Sykes, Henry, *Bayfield, Wis.*

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Tinker, E. F., *St. Johnsbury, Vt.*
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Webster, H. A., *Oregon City, Ore.*
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LIFE MEMBERS.

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Brower, J. F., *Torresdale Hatchery, Holmesburg, Pa.*
Buller, A. G., *Union City, Pa.*
Buller, Howard M., *Bellefonte, Pa.*
Buller, Nathan R., *Pleasant Mount, Pa.*
Buller, William, *Corry, Pa.*
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Fearing, Daniel B., *Newport, R. I.*
Haas, William, *Corry, Pa.*
Hogan, J. J., *Madison, Wis.*
Meehan, W. E., *Commissioner of Fisheries, Harrisburg, Pa.*
Safford, W. H., *Department of Fisheries, Harrisburg, Pa.*

HONORARY MEMBERS.

The President of the United States.
The Governors of the several states.
Adams, Fred J., *Grand Rapids, Mich.*
Antipa, Prof. Dr. Gregoire, *Inspector General of Fisheries, Bucharest, Roumania.*
Besana, Mr. Guiseppe, *President of the Lombardy Fisheries Society, Via Rugabella 19, Milan, Italy.*
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Cortelyou, Hon. George B., *Washington, D. C.*
Denbigh, Lord, *Colonel of the Honorable Artillery Company, London, England.*
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Kishinouye, Dr. K., *Imperial Fisheries Bureau, Tokyo, Japan.*
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Matsubara, Prof. S., *President Imperial Fisheries Institute, Tokyo, Japan.*
Metcalf, Hon. Victor H., *Secretary of the Navy, Washington, D. C.*
New York Association for the Protection of Fish and Game, *New York City.*
Nordqvist, Dr. Oscar Fritiof, *Superintendent of Fisheries, Lund, Sweden.*
Peck, Hon. George W., *Milwaukee, Wis.*
Perrier, Prof. Edmond, *Director National Museum of Natural History, Paris, France.*
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Von Grimm, Dr. Oscar, *Inspector-General of Fisheries, St. Petersburg, Russia.*

Von Kadich, Dr. Heinrich, *Department of Forestry and Domain, Vienna, Austria.*

Von Pirko, Franz, *President Austrian Fishery Society, Vienna, Austria.*

Woodmount Rod and Gun Club, *Washington, D. C.*

CORRESPONDING MEMBERS.

Ayson, Lake F., *Commissioner of Fisheries, Wellington, New Zealand.*

Ayson, Charles L., *Hakataemen, Oamaru, New Zealand.*

Apostolides, Prof. Nicoly Chr., *Athens, Greece.*

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Jaffe, S., *Osnabruck, Germany.*

Landmark, A., *Inspector of Norwegian Fresh Water Fisheries, Christiana, Norway.*

Marston, R. B., Esq., *Editor of the Fishing Gazette, London, England.*

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Sars, Prof. G. O., *Christiania, Norway.*

Solsky, Baron N. de, *Director of the Imperial Agricultural Museum, St. Petersburg, Russia.*

Trybom, Dr. Filip, *Stockholm, Sweden.*

RECAPITULATION.

Active	411
Life	14
Honorary	73
Corresponding	18
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Total membership.....	516

CONSTITUTION

(As amended to date.)

ARTICLE I.

NAME AND OBJECT.

The name of this Society shall be American Fisheries Society. Its object shall be to promote the cause of fish culture; to gather and diffuse information bearing upon its practical success, and upon all matters relating to the fisheries; the uniting and encouraging of all interests of fish culture and the fisheries, and the treatment of all questions regarding fish, of a scientific and economic character.

ARTICLE II.

MEMBERS.

Any person shall, upon a two-thirds vote and the payment of two dollars, become a member of this society. In case members do not pay their fees, which shall be two dollars per year, after the first year and are delinquent for two years, they shall be notified by the treasurer, and if the amount due is not paid within a month thereafter, they shall be, without further notice, dropped from the roll of membership. Any person can be made an honorary or a corresponding member upon a two-thirds vote of the members present at any regular meeting.

Any person shall, upon a two-thirds vote, and the payment of twenty-five dollars, become a life member of this society, and shall thereafter be exempt from all annual dues.

ARTICLE III.

OFFICERS.

The officers of this society shall be a president and a vice president, who shall be ineligible for election to the same office

until a year after the expiration of their term; a corresponding secretary, a recording secretary, a treasurer and an executive committee of seven, which, with the officers before named, shall form a council and transact such business as may be necessary when the society is not in session—four to constitute a quorum.

ARTICLE IV.

MEETINGS.

The regular meeting of the society shall be held once a year, the time and place being decided upon at the previous meeting, or, in default of such action, by the executive committee.

ARTICLE V.

ORDER OF BUSINESS.

1. Call to order by president.
2. Roll call of members.
3. Applications for membership.
4. Reports of officers.
 - a. President.
 - b. Secretary.
 - c. Treasurer.
 - d. Standing committees.
5. Committees appointed by the president.
 - a. Committee of five on nomination of officers for ensuing year.
 - b. Committee of three on time and place of next meeting.
 - c. Auditing committee of three.
6. Reading of papers and discussion of same.

(Note.—a. In the reading of papers preference shall be given to the members present.
b. The president and two secretaries are empowered to arrange the papers of the meetings of this society.)
7. Miscellaneous business.
8. Adjournment.

ARTICLE VI.

CHANGING THE CONSTITUTION.

The constitution of the society may be amended, altered or repealed by a two-thirds vote of the members present at any regular meeting, provided at least fifteen members are present at said meeting.